South Carolina. Coastal Zone Management Program

REPORT

OF THE

MARINE RESOURCES STUDY COMMITTEE

TO THE

SOUTH CAROLINA WILDLIFE AND MARINE RESOURCES COMMISSION

DECEMBER 1980

DRAFT
November 12, 1980

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ACRONYMS USED IN THIS REPORT

CFAP	-	Coastal Fisheries Assistance Program
CFMS	-	Commercial Fisheries Management Section
CHEC	-	Charleston Higher Education Consortium
CZMA	-	Coastal Zone Management Act
DCF	-	Division of Commercial Fisheries
DMR	-	Division of Marine Resources
FCMA	-	Fishery Conservation and Management Act
FCZ	-	Fishery Conservation Zone
IPA	-	Information and Public Affairs
MARMAP	-	Marine Resources Monitoring Assessment and Prediction Program
MRRI	-	Marine Resources Research Institute
NMFS	-	National Marine Fisheries Service
NOAA	-	National Oceanic and Atmospheric Administration
OCMM	-	Office of Conservation, Management, and Marketing
USC	-	University of South Carolina
WMRD	-	Wildlife and Marine Resources Department

Report

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SOUTH CAROLINA WILDLIFE AND MARINE RESOURCES COMMISSION

PREFACE

In the late 1960's, a group of consultants with expertise in the marine resources field representing both State and Federal agencies and the academic community was assembled by the South Carolina Wildlife and Marine Resources Commission to examine the marine resources of South Carolina and make recommendations for their orderly development and utilization. The group concluded rather quickly that South Carolina did indeed have valuable marine and coastal resources and further concluded that the State of South Carolina could ill afford to continue the level of neglect of these valuable resources that currently existed. As a consequence of these conclusions, the group was asked to develop recommendations to correct the situation. These recommendations were to include suggestions as to the best institutional structure to achieve an adequate marine research and management capability, where should such an institution be placed, and what should be the broad goals and capabilities of such an institution.

As a result of recommendations submitted by the Committee of Consultants in late 1968, the Commission acting with the General Assembly, created the Division of Marine Resources and began development of the facilities of the Marine Resources Center. The Division of Marine Resources was established to provide marine resources management, research and development in South Carolina. The Office of Marine Conservation Management and Services (now the Office of Conservation, Management and Marketing) and the Marine Research Laboratory (now called the Marine Resources Research Institute) was established in the newly created Division.

In late 1969, a final report ("A Plan for Marine Resources Research and Development in South Carolina") was submitted by the Division of Marine Resources noting the essential need to establish and effect a comprehensive research and development program within the State. Development of the Marine Resources Center was underway at Fort Johnson, Charleston, and in 1971, the South Carolina Commission on Higher Education accepted the Department's "Proposed Plan of Marine Development for the State of South Carolina." By Executive Order, Governor John C. West officially adopted this plan, designated the Marine Resources Center as the focal point for the development of South Carolina's Sea Grant Program, and redesignated the Marine Resources Center as the South Carolina Coastal Zone Laboratory for marine research.

In 1972, the Sea Grant Program was established with Dr. Edwin B. Joseph as Sea Grant Coordinator and funds were first received for the program. In 1973, an agreement between the South Carolina Commission on Higher Education and the Department was signed which led to the development of the Cooperative Research Facility.

In 1974, the Division of Marine Resources established a coastal zone planning program pursuant to the Coastal Zone Management Act of 1972. This program later became the primary component of a new division in the Department and efforts were undertaken to establish legislation for coastal zone management in South Carolina which was finally adopted by the General Assembly and signed into law in 1977. In addition, legislation was adopted in 1978 establishing the South Carolina Sea Grant Program as a separate State agency.

Since the time of the study by the consultants in the late 1960's, there have been various changes in the marine resources field in South Carolina and the Commission felt it was appropriate to assemble another committee of consultants to review the programs and activities of the Division of Marine Resources.

The Division of Marine Resources has now completed a decade of growth and development, and is now entering the decade of the 1980's. The Commission's charge to the present Committee was to first review that past decade of growth and development with respect to several specific areas. Were the original goals and program areas realistic ones for the seventies? Have those goals been followed reasonably well? Has reasonable progress been made towards achieving these goals? Has the staff been developed in a fashion consistent with the recommended program areas? Is the quality of the staff and the quality and productivity of the program such that the Commission can justifiably take pride in the Division and its operation?

The second phase of the charge was considered to be of even greater importance and future utility to the Commission. This phase deals with the decade of the eighties. The specific questions that were to be explored

included consideration of to what extent the goals and programs of the seventies need to be modified to meet the expected problems and opportunities of the eighties. What about program emphasis? Were some areas receiving relatively more emphasis than they appear to deserve while other areas were not receiving adequate attention? Did the Committee see program areas that may have been worthy at some point in the past but can no longer be justified? Does the internal organization of the Division appear reasonable in light of the mission and goals?

The third phase of the charge to the Committee dealt with the funding base of the Marine Resources Program. This would involve analyzing the funding sources that support the Marine Center's programs, determining funding needs in light of recommended areas of program emphasis for the future and making recommendations regarding alternatives for funding these programs.

During the early part of 1980, the South Carolina Wildlife and Marine Resources Commission authorized and requested that a Marine Resources Study Committee be established to review the programs and activities of the Division of Marine Resources located within the South Carolina Wildlife and Marine Resources Department. This Study Committee was established in April 1980 and consisted of the following individuals:

Mr. Irwin M. Alperin, Executive Director, Atlantic States Marine Fisheries Commission, Washington, D.C.

The Honorable R. Linwood Altman, House of Representatives, South Carolina State Legislature, Columbia, South Carolina.

Mr. Benjamin T. Hardesty, Member, South Atlantic Fishery Management Council, Columbia, South Carolina.*

Dr. Robert F. Hutton, Recreational Fisheries Coordinator, National Marine Fisheries Service, Washington, D.C.

Dr. Jon M. Lindbergh, Domsea Farms, Inc., Bremerton, Washington.

Mr. Richard H. Stroud, Executive Vice President, Sport Fishing Institute, Washington, D.C.

Mr. Walter D. Toler, President, South Carolina Shrimper's Association, Mt. Pleasant, South Carolina.

Senator James M. Waddell, South Carolina State Legislature, Columbia, South Carolina.

Mr. Walter V. Zachowski, South Carolina Marine Advisory Board, Beaufort, South Carolina.

The South Carolina Wildlife and Marine Resources Commission and the administration of the State Wildlife and Marine Resources Department stated that they would welcome the kind of guidance and constructive criticism the 1980 Study Committee could develop from a careful consideration of the issues and questions mentioned above.

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* Mr. Hardesty changed jobs and resigned from the Study Committee on July 23, 1980. However, he continued to serve as a member of the South Atlantic Fishery Management Council.

I. INTRODUCTION

During the course of this review and evaluation, the Study Committee met as a group three times in South Carolina within a period of less than five months (i.e., June 9, 1980-October 2, 1980). Several institutions and key individuals (see below) were visited by Chairman Robert F. Hutton on behalf of the Study Committee. Additional discussions and conferences were held in Washington, D.C., Columbia, South Carolina, and Charleston, South Carolina.

A brief chronological summary of important Study Committee activities follows:

April 1, 1980

Letter dated April 1, 1980, from Dr. James A. Timmerman, Jr., Executive Director, South Carolina Wildlife and Marine Resources Department, to Dr. Robert F. Hutton, National Marine Fisheries Service, Washington, D.C. inviting him to chair a Study Committee to review programs and activities of the Department's Division of Marine Resources.

May 12, 1980

Meeting in Columbia, South Carolina, involving Mr. J. Drake Edens, Jr., Chairman, South Carolina Wildlife and Marine Resources Commission, J.A. Timmerman, Jr., and R.F. Hutton to discuss the Commission's specific charges to the Study Committee and proposed meetings and activities of the Study Committee.

June 9-10, 1980

Organizational meeting of Marine Resources Study Committee in Charleston, South Carolina. Study Committee members attending were: R.F. Hutton, Chairman; I.M. Alperin, R.L. Altman; R.H. Stroud; and W.V. Zachowski. A copy of the agenda for the meeting is included as APPENDIX I.

July 7, 1980

Discussions were conducted between R.F. Hutton and Dr. Edwin B. Joseph, Director, South Carolina Marine Resources Division, on Division financial needs, communications, and other matters. Dr. Hutton also discussed marine law enforcement problems and conflicting laws with Mr. J. Oscar Sullivan, Assistant Chief, District 9, Coastal Environment and Enforcement, Charleston, South Carolina.

Chairman Hutton met with Dr. John M. Armstrong, Director, South Carolina Sea Grant Consortium, in Charleston, to discuss the Study Committee's assignment and the activities of the South Carolina Sea Grant Consortium.

Chairman Hutton also met with Dr. Stanford R. Beebe, Director, Marine Programs, Coastal Plains Regional Commission in Charleston, South Carolina, to discuss the Study Committee's assignment, the working relationship between the Coastal Plains Regional Commission and the South Carolina Division of Marine Resources, and the outlook for the Commission's funding of marine resources projects.

July 8, 1980

Messrs. J.A. Timmerman, Jr., E.B. Joseph, and R.F. Hutton met in Columbia, South Carolina, to discuss the work of the Marine Resources Study Committee. Dr. Timmerman indicated that he would try to make a copy of the draft report of the Department's Study Committee on Program Funding available to the Marine Resources Study Committee during August 1980.

Chairman Hutton met with Dr. John M. Dean, Director, Marine Science Program, University of South Carolina (USC), in Columbia, South Carolina, to discuss the relationship between the USC Marine Science Program and the South Carolina Division of Marine Resources Program. Included in these discussions were the University's coastal ecology and teaching programs at Columbia, Georgetown, and Beaufort, South Carolina.

Chairman Hutton met with Dr. H. Wayne Beam, Executive Director, South Carolina Coastal Council in Columbia, South Carolina, to discuss the relationship between the South Carolina Coastal Zone Program and the South Carolina Division of Marine Resources Program. Discussions centered around research needs and better use of the South Carolina Marine Resources Advisory Board. Dr. Beam stated that, in many cases, research is dictating what is being done when, in reality, management should be identifying needs.

July 9-10, 1980

Second meeting of the Marine Resources Study Committee in Charleston, South Carolina. Study Committee members attending were: R.F. Hutton, Chairman; I.M. Alperin, R.L. Altman; B.T. Hardesty;

R.H. Stroud; W.D. Toler; and W.V. Zachowski. A copy of the agenda for this meeting is included as APPENDIX II.

August 25, 1980

Messrs. I.M. Alperin, W.D. Toler, W.V. Zachowski, and staff members of the South Carolina Division of Marine Resources met to discuss the status of South Carolina marine fisheries resources, liaison between the South Carolina Marine Resources Division and industry, and other matters.

August 26, 1980

Messrs. J.M. Lindbergh, J.M. Waddell, and P.A. Sandifer met in Charleston, South Carolina to review the history, funding, and problem areas within the mariculture programs of the South Carolina Marine Resources Research Institute. As a result of this meeting it was agreed that the "Aquaculture goal" (i.e., Goal IV) should be revised.

September 4, 1980

Messrs. R.F. Hutton, I.M. Alperin, and R.H. Stroud met in Washington, D.C., to review Study Committee assignments dealing with the status of South Carolina marine resources, marine resources program financial needs, and possible funding sources, etc.

September 29, 1980

Meeting in Columbia, South Carolina, between J.A. Timmerman and R.F. Hutton to discuss the agenda for the Study Committee meeting on October 1-2, 1980, and plans for producing a final report.

October 1-2, 1980

Third and final meeting of the Marine Resources Study Committee in Charleston, South Carolina. Study Committee members attending were: R.F. Hutton, Chairman; I.M. Alperin; R.L. Altman; R.H. Stroud; W.D. Toler; J.M. Waddell; and W.V. Zachowski. A copy of the agenda for this meeting is included as APPENDIX III.

II. A REVIEW OF SOUTH CAROLINA MARINE RESOURCES

(The biological resources, commercial fisheries, and sport fisheries comparing the findings of the 1968 report of the Committee of Consultants with the perception of these resources today.)

Then

The Committee of Consultants on Marine Resources and Marine Sciences in their 1968 report to the South Carolina Wildlife Resources Commission quickly concluded that, "The biological resources of the marine environment of South Carolina are numerous, supporting commercial and recreational fisheries of increasing economic significance. Their potential for continuing, even markedly increasing utilization, is real." At the same time, they reported that commerical landings of fish and shellfish over the years remained at a relatively low plateau (when compared with other South Atlantic States) amounting to less than 30,000,000 pounds per year and averaging less than $4,000,000 in landings value (see TABLES I, II, and III). Further, based on a variety of information sources including the 1960 and 1965 Saltwater Angling Surveys conducted by the Bureau of Census and reported and interpreted by biologists of the U.S. Bureau of Sport Fisheries and Wildlife, the Committee concluded that "marine sport fishing in South Carolina is a

TABLE I.

SOUTH CAROLINA COMMERCIAL FISHERIES LANDINGS (1958-1967)*

(Marine and Freshwater)

	1958	1959	1960	1961	1962
Lbs.	16,200,000	23,443,000	24,300,000	19,242,000	22,680,000
$ Value	2,965,000	2,936,000	4,039,000	3,345,000	4,720,000

	1963	1964	1965	1966	1967
Lbs.	22,015,000	21,723,000	26,611,000	23,191,295	18,867,208
$ Value	3,236,000	3,001,000	4,928,000	4,199,260	3,219,668

*From "Fishery Statistics of the United States for the years 1958-1967" as prepared by the Bureau of Commercial Fisheries, U.S. Fish and Wildlife Service, Department of the Interior, Washington, D.C.

TABLE II.

SOUTH ATLANTIC STATES COMMERCIAL FISHERIES LANDINGS (1965)*

(Marine and Freshwater)

STATE	LBS.	$ VALUE
North Carolina	233,961,000	9,241,000
South Carolina	26,611,000	4,928,000
Georgia	20,059,000	4,140,000
Florida (East Coast only)	76,021,000	8,480,000

* From Fishery Statistics of the United States 1965, Statistical Digest No. 59, Bureau of Commercial Fisheries, Fish and Wildlife Service, U.S. Department of the Interior, Washington, D.C.

TABLE III.

FISCAL YEAR 1968 CALCULATED APPORTIONMENT OF FUNDS UNDER THE COMMERCIAL FISHERIES RESEARCH AND DEVELOPMENT ACT OF 1964 (PUBLIC LAW 88-309)*

(Southeastern States Only)

	Average[1] Value of Raw Fish Harvested 1963-65	Average[2] Value of Manufactured Products 1963-65	Average Value Of Landings And Manufactured Products, 1963-65	Percent	Allocations Of Funds To States
Virginia	$23,415,000	$27,251,000	$50,666,000	3.59	$181.6
North Carolina	8,182,000	8,199,000	16,381,000	1.16	58.7
South Carolina	3,722,000	2,453,000	6,175,000	.44	22.1
Georgia	3,242,000	22,572,000	25,814,000	1.83	92.6
Florida	31,727,000	56,164,000	87,891,000	6.23	246.0
Alabama	5,086,000	7,305,000	12,391,000	.88	44.4
Mississippi	8,997,000	23,658,000	32,655,000	2.32	117.1
Louisiana	36,086,000	58,149,000	94,235,000	6.68	246.0

1. Ex-vessel value
2. Gross Amount received by the processor at the point of production.
3. A maximum of 6 percent and a minimum of 1/2 of 1 percent, are assured under the allocation. Dollar amounts in thousands

* From: Congressional Record, Vol. 114, No. 122, July 29, 1968

valuable industry, ...it will grow at a rapid pace for the next several years and become more valuable." In that period, it was variously estimated there were 175,000 to 250,000 anglers fishing in the saltwaters of South Carolina and their expenditures approximated $14,000,000 to $20,000,000 annually. There is no specific reference to the numbers and varieties of fish that compose the recreational catch and no reference to recreational fisheries for shrimp, crabs, and shellfish.

The Committee of Consultants had access to a preliminary report on the status of the saltwater sport fisheries of South Carolina and briefly summarized the report without providing information on the magnitude of these fisheries. A comprehensive final report (C.M. Bearden, 1969) provides estimates of the amplitude of the fisheries, numbers of participants, economic importance, methodology, species that enter the fisheries, future of the fisheries, and recommendation for research, development, and management of the State's saltwater sport fishing resources (see APPENDIX IV).

In generalizing on the species of economic significance that support the commercial and recreational fisheries, reference is made to oysters, shrimp, blue crabs, menhaden, sciaenids (weakfishes and drums), and clupeids (herring-like) as already in use; and thread herring, squid, butterfish, conch, and sharks as a basis for additional fisheries. This is substantiated somewhat by a Table (see TABLE IV) showing an eleven-year summary of leading commercial fisheries landings and their values. In 1967, for example, the leading species in volume (pounds) were blue crabs, shrimp, alewives (blueback herring), oysters, spot, mullet, king-whiting, and seabass--the number, value, and order

TABLE IV. ELEVEN-YEAR SUMMARY OF LEADING SOUTH CAROLINA MARINE COMMERCIAL FISHERIES *

	1957		1958		1959		1960		1961		1962	
	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value
Alewives												
Blue crabs	3,584,400	179,276	4,839,400	241,970	4,772,000	263,000	7,120,795	534,000	4,672,000	186,000	6,338,000	293,000
King whiting	97,500	6,825	52,900	3,238	66,000	3,000	218,824	19,000	360,000	47,000	296,000	36,000
Mullet	2,574,800	231,645	1,924,000	173,070	2,548,000	153,000	2,495,501	150,000	2,840,000	256,000	2,480,000	223,000
Oysters	1,844,500	369,846	1,437,100	288,197	1,918,000	379,000	2,627,505	920,000	2,544,000	1,095,000	2,674,000	1,168,000
Sea bass	4,600	920	17,700	3,030	38,000	6,000	29,142	5,000	324,000	64,000	268,000	43,000
Shrimp	6,689,800	1,750,821	5,815,300	2,090,619	7,515,000	1,917,000	8,030,524	2,167,000	3,907,000	1,301,000	6,474,000	2,613,000
Spot	2,097,400	105,554	841,900	50,514	1,841,000	73,000	2,720,621	109,000	3,468,000	207,000	3,135,000	188,000

	1963		1964		1965		1966		1967	
	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value
Alewives					2,760,000	55,000	2,817,000	56,340	2,802,000	56,040
Blue crabs	8,839,000	423,000	9,436,123	375,761	7,419,940	369,208	5,724,458	283,860	5,247,203	290,256
King whiting	246,000	32,000	246,030	68,672	315,000	32,000	161,162	17,948	121,834	10,957
Mullet	2,211,000	166,000	680,052	47,704	3,191,157	444,909	3,258,212	193,661	768,500	58,980
Oysters	3,827,000	1,556,000	2,511,071	996,960	2,805,228	902,482	1,614,816	1,066,734	2,255,476	846,937
Sea bass	265,000	40,000	233,798	31,352	83,000	11,000	136,255	16,669	66,106	8,434
Shrimp	2,201,000	643,000	2,631,956	860,920	6,794,579	2,634,989	4,263,448	2,180,590	4,088,205	1,678,568
Spot	2,719,000	146,000	3,165,983	213,192	1,173,914	148,422	2,125,503	91,950	2,219,045	99,335

* From "Fishery Statistics of the United States for the years 1957-1967 as prepared by the Bureau of Commercial Fisheries, Fish and Wildlife Service, U.S. Department of the Interior, Washington, D.C.,

of abundance fluctuating over the years. Suggestion is made that there are quantities of off-shore coastal schoolfishes such as anchovy and round herring that could be exploited, as well as certain bottom fishes, such as vermilion snapper, that would support small fisheries.

The 1968 consultants also thought there was a basis of resources for an "industrial" fishery in the vicinity of Charleston, and offshore fisheries for calico scallops and thread herring were additional potentials.

In the 1968 report, there is a paucity of hard data on the magnitude of the living marine resources excepting for certain commercial fisheries landings--traditionally high value oysters, shrimp and blue crabs, and a few species of less valuable finfishes. In the period from 1958-1967, according to Bureau of Commercial Fisheries data, commercial fisheries landings ranged from a low (1958) of 16,200,000 pounds to a high (1965) of 26,600,000 pounds, and a dollar value of $2,940,000 in 1959 to one-and-one half times that amount, $4,930,000 million in 1965. In 1965, at the above high landing and value levels, South Carolina ranked third in fish and shellfish landings among the four South Atlantic States. It is significant to note that based on the average value of raw fish harvested in the period from 1963-1965 ($3,722,000) and the average value of manufactured products in the same period ($2,453,000), South Carolina fared poorly in the apportionment of grant-in-aid funds under the Commercial Fisheries Research and Development Act, its percentage being only .44 and funding allocations just $22,100. In contrast, North Carolina received $58,700.00; Georgia, $92,600. and Florida, $246,000. We show below that although the value of South Carolina raw fish harvested and fish products manufactured has

increased fourfold in the period from 1976-1978, the relative percentage and allocation of funds has remained the same.

The eleven-year summary of leading South Carolina commercial fisheries landings (TABLE IV) reveals the magnitude and fluctuation of the fisheries prior to 1968, but these figures may not always reflect the status of the resource because they do not reveal the effort or availability of the selected species. Of the finfish, the data for 3 years for alewives (blueback herring) is very stable, at about 2,800,000 pounds, but spot range from 842,000 pounds to 3,500,000 pounds and were equal at 2.0+ million pounds in 1957 and 1967, 11 years apart. Black seabass landings amounted to only 4,600 pounds in 1957, increased to 324,000 pounds in 1961, fell back to 83,000 pounds in 1965, and a recent low of 66,000 pounds in 1967. King-whiting landings averaged about 200,000 pounds during that period, but were only 53,000 pounds in 1958, and a below-average year of 122,000 pounds in 1967. Mullet appear to be plentiful during these years, most years producing more than 2.0 million pounds, but there are lows of only 680,000 pounds in 1964, and 768,000 pounds in 1967.

Shellfish landings during this 11-year period may be more truly indicative of resource abundance because they are high-value products and intensively fished. Blue crabs, only once in 11 years, were below 4,000,000 pounds, reaching between 7 and 8+ million pounds in 3 years, peaking at almost 9,500,000 million pounds in 1964, and leveling off at about 5,500,000 pounds the last years of that period. Oyster landings were quite stable, close to 2,500,000 or more pounds in most years with a peak at 3,800,000 in 1963, but dropping to a low of 1,400,000 million pounds in 1958. Shrimp, a 1-year crop, fluctuated considerably over the

years, but averaged greater landings in the late 1950's and early 1960's than they did in the later years of the Report's time frame. From 1957 to 1960, shrimp landings exceeded 5,800,000 pounds each year, peaking at 8,000,000 pounds in 1960, but dropping to 4,000,000 pounds in 1961. From 1963 to 1967, several years produced only 2,000,000+ pounds with peak landings of 6,800,000 pounds in 1965, but little more than 4,000,000 pounds in both 1966 and 1967.

In terms of dollar values, the three invertebrates were the mainstay of the industry, but the value of the blue crab landings were rivaled or exceeded, in some years, by those for mullet and/or spot.

As noted above from the consultant's report, there is little factual material about the resources and catch of South Carolina's sport fisheries. The inference is that they are substantial, since the Saltwater Surveys of 1960 and 1965 showed that in the South Atlantic region (Cape Hatteras to the Florida Keys), anglers landed 157,000,000 fish in 1960 and 191,000,000 fish in 1965. Inshore species such as croakers, spot, porgies, and grunts provided the greatest increases between these years; but king mackerel, Spanish mackerel, and yellowtail snapper catches also increased substantially. Some of these species, i.e., yellowtail snapper, are of little consequence in South Carolina sport fisheries.

Reference is also made to the development of marine resources thorugh the activities of the Bears Bluff Laboratories involving the experimental aquaculture of oysters, shrimp and other species, but no specifics are provided except reference to 48 published "Contributions," and that pond culture work had attracted the interest of commercial marine aquaculture ventures.

The above is descriptive of the Committee of Consultants' perspective of South Carolina's living marine resources, their fisheries, and the potential for expansion.

Now

In contrast to the lack of specific data obtainable from the 1968 report of the Committee of Consultants on the magnitude of the marine resources of South Carolina and its dependent commercial and sport fisheries, the establishment of the Division of Marine Resources (DMR) and its multi-faceted activities provides a much more comprehensive view of the State's living marine resources and their potential for expansions. This modern perspective is derived from such sources as surveys and exploratory fishing, stock assessments, improved and expanded collection of fisheries statistics, both commercial and recreational, dockside sampling, and a variety of monitoring and observation programs

In addition, there is more expansive and comparative data from the National Marine Fisheries Service (NMFS) for commercial fisheries landings, and several marine recreational fisheries surveys which provide a measure of the South Atlantic and/or South Carolina sport fisheries landings by species, their number and weight, and the number of participating anglers. All these data provide a better basis for evaluating the resource and its potential.

Traditionally, in the past, South Carolina's commercial fisheries were predominantly for shellfish--shrimp, oysters, and blue crab--while recently significant landings of finfish, including a substantial number of species, were not recognized to be of consequence in 1968. These include the snapper-grouper complex (including the red porgy) and swordfish, all offshore fisheries. In 1979, for example, the former group accounted for about 1,000,000 pounds in contrast to the more traditional seabass fishery, which landed only 228,000 pounds. The swordfish fishery also produced 823,000 pounds valued at over a million dollars. The total of finfish landings in this recent year was about 3,750,000 pounds valued at $2,640,000, making finfish rank second in landings value when compared with shrimp, crabs, and oysters--a distinct change in resource utilization in South Carolina. Nevertheless, as shown in TABLE V, when compared with 1965 (South Carolina landings of 26,611,000 pounds), 1979 (South Carolina landings of 21,449,000 pounds) produced fewer fish and shellfish although the value of these resources increased fivefold (from about $5,000,000 to about 25,800,000). South Carolina again rated last in volume and dollar value among the four South Atlantic states. Also, in a comparison of Fiscal Year 1968 versus Fiscal Year 1981, calculated apportionment of grant-in-aid funds under the Commercial Fisheries Research and Development Act (TABLE VI), South Carolina fares no better in 1981 than it did in 1968, ranking last in percentage (.44) and funding ($27.8 thousand) among South Atlantic and Gulf of Mexico States.

Only a few commerical fisheries have developed substantially among those suggested in 1968 for their potential--thread herring, round herring, anchovy, butterfish, sharks, squid, conchs, calico scallops,

TABLE V.

SOUTH ATLANTIC STATES COMMERCIAL FISHERIES LANDINGS
(1965 and 1979)*
(Marine and Freshwater)

1965

STATE	LBS.	$ VALUE
North Carolina	233,961,000	$ 9,241,000
South Carolina	26,611,000	4,928,000
Georgia	20,059,000	4,140,000
Florida (East Coast only)	76,021,000	8,480,000

1979

North Carolina	390,472,000	$58,454,000
South Carolina	21,449,000	25,792,000
Georegia	21,670,000	26,365,000
Florida (East Coast Only)	54,592,000	33,170,000

* From Fishery Statistics of the United States 1965, Statistical Digest No. 59, Bureau of Commercial Fisheries, Fish and Wildlife Service, U.S. Department of the Interior, Washington, D.C., and Fisheries of the United States 1979 (April 1980), Current Fishery Statistics No. 8000, National Marine Fisheries Service, U.S. Department of Commerce, Washington, D.C. 20235

TABLE VI.

FISCAL YEAR 1968 AND FISCAL YEAR 1981 CALCULATED APPORTIONMENT OF FUNDS UNDER THE COMMERCIAL FISHERIES RESEARCH AND DEVELOPMENT ACT OF 1964 (PUBLIC LAW 88-309, AS AMENDED)*
(Southeastern States Only)

	Average [1] Value of Raw Fish Harvested 1963-65	Average[2] Value of Manufactured Products 1963-65	Average Value Of Landings And Manufactured Products, 1963-65	Percent	Allocations [3] Of Funds To States
Virginia	$23,415,000	$27,251,000	$50,666,000	3.59	$181.6
North Carolina	8,182,000	8,199,000	16,381,000	1.16	58.7
South Carolina	3,722,000	2,453,000	6,175,000	.44	22.1
Georgia	3,242,000	22,572,000	25,814,000	1.83	92.6
Florida	31,727,000	56,164,000	87,891,000	6.23	246.0
Alabama	5,086,000	7,305,000	12,391,000	.88	44.4
Mississippi	8,997,000	23,658,000	32,655,000	2.32	117.1
Louisiana	36,086,000	58,149,000	94,235,000	6.68	246.0

	Average [1] Value of Raw Fish Harvested 1976-78	Average[2] Value of Manufactured Products 1976-78	Average Value Of Landings And Manufactured Products, 1976-78	Percent	Allocations [3] Of Funds To States
Virginia	$53,109,000	$100,120,000	$153,229,000	2.75	$172.6
North Carolina	32,309,000	31,855,000	64,164,000	1.15	72.3
South Carolina	13,199,000	11,496,000	24,695,000	.44	27.8
Georgia	12,013,000	57,368,000	69,381,000	1.24	78.2
Florida	94,166,000	233,597,000	327,763,000	5.88	300.0
Alabama	35,768,000	91,574,000	127,342,000	2.29	143.4
Mississippi	49,004,000	108,584,000	157,588,000	2.83	177.5
Louisiana	158,384,000	216,748,000	375,132,000	6.73	300.0

1. Ex-vessel value
2. Gross Amount received by the processor at the point of production.
3. A maximum of 6 percent and a minimum of 1/2 of 1 percent, are assured under the allocation. Dollar amounts in thousands.

* From: Congressional Record, Vol. 114, No. 133, July 29, 1968, and unpublished data from the National Marine Fisheries Service.

and vermilion snapper. Of these, no fisheries have developed for thread herring, round herring, anchovy, butterfish, sharks or squid. Vermilion snapper are included in the landings of the newly-developed snapper-grouper fishery, contributing 93,000 pounds worth $134,000 in 1979; a bed of calico scallops discovered by DMR exploration produced 85 thousand gallons of meats worth more than $750,000 and the scallop survey continues; and a small winter trawl fishery for conchs (whelks), about 14,000 bushels in 1979, is increasing. Unheralded in 1968, a new fishery for offshore rock shrimp is contributing to shrimp landings. About 464,000 pounds, worth $481,000 were landed in 1979. Other large-volume species of shellfish and finfish not recognized for their contributions in 1968 include catfish (217,000 pounds), hard clams (195,000 pounds of meats valued at $464,000), American shad, and a small but significant fishery for Atlantic sturgeon which may be enhanced with hatchery-reared fingerlings.

As shown in TABLE VII, a twenty-three year summary of South Carolina commercial fisheries landings, the traditional species have had their ups and downs. The most important crop, shrimp, except in 1977 and 1978, when the stock was affected by adverse cold weather, were fully utilized at a much higher than average abundance, reaching 175,000,000 pounds in 1971, close to 9,000,000 pounds in 1975, and a value exceeding $20,000,000 in 1979. Blue crab landings remain high and the crop appears fully utilized, the latest landing being about 7,700,000 pounds valued at close to $2,000,000. To increase economic efficiency, an effort is being made to establish a soft crab industry since the product is worth up to 20 times that of hard crab. Oyster

TABLE VII. TWENTY-THREE YEAR SUMMARY OF LEADING SOUTH CAROLINA MARINE COMMERCIAL FISHERIES

	1957		1958		1959		1960		1961		1962	
	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value
Alewives												
Blue crabs	3,584,400	179,276	4,839,400	241,970	4,772,000	263,000	7,120,795	534,000	4,672,000	186,000	6,338,000	293,000
King whiting	97,500	6,825	52,900	3,238	66,000	3,000	218,824	19,000	360,000	47,000	296,000	36,000
Mullet	2,574,800	231,645	1,924,000	173,070	2,548,000	153,000	2,495,501	150,000	2,840,000	256,000	2,480,000	223,000
Oysters	1,844,500	369,846	1,437,100	288,197	1,918,000	379,000	2,627,505	920,000	2,544,000	1,095,000	2,674,000	1,168,000
Sea bass	4,600	920	17,700	3,030	38,000	6,000	29,142	5,000	324,000	64,000	268,000	43,000
Shrimp	6,689,800	1,750,821	5,815,300	2,090,619	7,515,000	1,917,000	8,030,524	2,167,000	3,907,000	1,301,000	6,474,000	2,613,000
Spot	2,097,400	105,554	841,900	50,514	1,841,000	73,000	2,720,621	109,000	3,468,000	207,000	3,135,000	188,000

	1963		1964		1965		1966		1967		1968	
	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value
Alewives					2,760,000	55,000	2,817,000	56,340	2,802,000	56,040	2,280,000	48,000
Blue crabs	8,839,000	423,000	9,436,123	375,761	7,419,940	369,208	5,724,458	283,860	5,247,203	290,256	3,862,000	295.000
King whiting	246,000	32,000	246,030	68,672	315,000	32,000	161,162	17,948	121,834	10,957	300,000	25,000
Mullet	2,211,000	166,000	680,052	47,704	3,191,157	444,909	3,258,212	193,661	768,500	58,980	1,480,000	110,000
Oysters	3,827,000	1,556,000	2,511,071	996,960	2,805,228	902,482	1,614,816	1,066,734	2,255,476	846,937	2,120,000	1,050,000
Sea bass	265,000	40,000	233,798	31,352	83,000	11,000	136,255	16,669	66,106	8,434	204,000	32,000
Shrimp	2,201,000	643,000	2,631,956	860,920	6,794,579	2,634,989	4,263,448	2,180,590	4,088,205	1,678,568	6,334,000	3,686,000
Spot	2,719,000	146,000	3,165,983	213,192	1,173,914	148,422	2,125,503	91,950	2,219,045	99,335	2,052,000	90,000

* From "Fishery Statistics of the United States for the years 1957-1967 as prepared by the Bureau of Commercial Fisheries, Fish and Wildlife Service, U.S. Department of the Interior, Washington, D.C., and 1968-1979 by the National Marine Fisheries Service U.S. Department of Commerce, Washington, D.C.

TABLE VII. (Continued)

	1969		1970		1971		1972		1973		1974	
	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value
Ale-wives	1,975,000	30,000	100,000	2,000	718,000	12,000	297,000	6,000	433,000	13,000	87,000	3,000
Blue crabs	8,250,000	675,000	6,950,000	455,000	7,508,000	616,000	7,422,000	778,000	7,952,000	1,144,000	7,548,000	984,000
King whiting	93,000	10,000	95,000	11,000	155,000	17,000	173,000	21,000	194,000	31,000	110,000	18,000
Mullet	852,000	77,000	859,000	17,000	675,000	45,000	521,000	23,000	240,000	27,000	845,000	83,000
Oysters	964,000	559,000	852,000	485,000	1,101,000	602,000	1,120,000	603,000	878,000	505,000	1,119,000	657,000
Sea bass	722,000	169,000	773,000	165,000	514,000	132,000	547,000	199,000	287,000	87,000	134,000	47,000
Shrimp	5,817,000	3,428,000	4,951,000	2,879,000	10,753,000	6,388,000	8,085,000	5,547,000	8,256,000	8,907,000	7,429,000	4,853,000
Spot	454,000	43,000	368,000	37,000	1,286,000	83,000	2,269,000	207,000	1,455,000	233,000	358,000	40,000

	1975		1976		1977 (Prel.)		1978 (Prel.)		1979 (Prel.)			
	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value	Lbs.	Value
Ale-wives	18,000	1,000	67,000	3,000	323,000	21,000	196,000	16,000	334,000	100,000		
Blue crabs	6,380,000	843,000	5,740,000	976,000	7,336,000	1,567,000	9,397,000	1,840,000	7,730,000	1,903,000		
King whiting	93,000	18,000	61,000	13,000	19,700	4,000	94,000	14,400	91,000	19,100		
Mullet	683,000	70,000	3,536,000	426,000	1,083,000	145,000	649,000	130,000	49,000	7,000		
Oysters	1,037,000	616,000	1,187,000	759,000	1,280,000	867,000	1,538,000	1,146,000	1,690,000	1,335,000		
Sea bass	146,000	45,000	90,000	27,000	17,000	6,000	56,000	29,000	220,000	106,000		
Shrimp	8,866,000	10,803,000	8,653,000	11,043,000	4,283,000	5,770,000	5,084,000	9,652,000	8,015,000	19,456,000		
Spot	1,491,000	253,000	1,013,000	181,000	294,500	59,000	400,900	96,600	418,400	123,000		

resources, while historically much reduced, remain stable at about 1,000,000 to 1,500,000 pounds of meats (509 thousand bushels in 1979) valued at $1,300,000.

The current status of the South Carolina molluscan shellfish resources (oysters and hard clams) is presented in a 17-page report "Background Information Concerning the Shellfish Situation in South Carolina," which includes a description of the resource and the fisheries, the current management system for the commercial and recreational fisheries, and 13 recommendations to upgrade the industry and improve recreational opportunities (see APPENDIX V).

Of the substantial finfish fisheries recorded in the 23-year summary, blueback herring landings are very substantially reduced on the average, but modest landings of 334,000 pounds in 1979 brought by far the highest value recorded for this species--$100,000; king whiting landings in the late 1970's are much reduced from the average landings of the 1960's; mullet landings fluctuate substantially from year to year and are at their lowest landing level in 1979 (49,000 pounds); seabass landings were poor in the late 1970's but show signs of recovery in 1979; and spot are reduced to about one-third or less the landings' average of the 1950's and 1960's.

Finally, for commercial fisheries development, the Committee of Consultants speculated on the expansion of an industrial fishery effort (as a by-catch or indirect catch of the shrimp trawl industry). A MRRI report in 1976 (Technical Report No. 16) estimates that while between 8,000,000 and 36,000,000 pounds of fish were caught incidental to shrimping in 1974, and similar quantities in 1975, the majority of this resource, which is discarded, is of no value to the industry because no

where are other finfish processed

processing facility exists in South Carolina. Further, it is doubtful that incidental catches can be economically utilized since the price paid for such catch fails to provide sufficient incentive to land a dependable supply. A small quantity of the larger fish caught--incidental to shrimping--particularly croaker, flounders, spot, kingfishes, and mackerel, are landed (an estimated 168,000 pounds in 1974).

The 1980 Study Committee, however, pointed out that many of the species discarded were of value or potential value to the recreational fisheries, and that a study should be conducted to evaluate the loss of these fish to the angler.

Today's recreational fisheries and fish resources are much better documented than what was available to the Committee of Consultants and what was contained in their 1968 report. The DMR's Recreational Finfish Section conducts surveys such as the billfish survey which documents landings of marlin, sailfish, and swordfish; participates in the collection and analysis of catch-effort data, and length and weight of billfish taken in offshore tournaments, has reported on a Sportfishing Survey (in 1978) at Murrells Inlet, participates in the NMFS' National Recreational Saltwater Fishing Survey in South Carolina, conducts a postcard questionnaire survey of gillnet, gigging, and swimfish license holders, sponsors a marine gamefish tagging program, assists in numerous saltwater fishing tournaments, and maintains a State Record Sportfish Program. All these activities, plus the monitoring of an extensive artificial reef program, the maintenance of 30 State shellfish grounds, open to public use, provide much evaluation of the recreational finfish and shellfish resources and participant activities. A recently

published guide to saltwater recreational fisheries in South Carolina, and a companion recreational guide to oystering, clamming, shrimping and crabbing in South Carolina depict the species available to users, information on each species, and the wheres and whens of recreational finfishing and shellfishing. The former guide shows that more than 50 species or species groups of finfishes are available to inshore and offshore anglers. Inshore among the more populous species are red and black drum, croaker, spot, flounder, sheepshead, whiting, striped bass, spotted seatrout, weakfish, and cobia. Offshore pelagic species include tunas and bonitos, wahoo, mackerel, jacks, bluefish, dolphin, marlin, sailfish, and swordfish. Offshore on natural bottoms or artificial reefs are abundant black seabass, numerous species of snappers, groupers, porgies, and grunts.

A number of NMFS reports in recent years provide data on regional and State specific marine recreational finfishing and shellfishing. TABLE VIII, from a 1974 report, indicates that there were 185,000 finfishing households and 396,000 marine recreational finfish fishermen in South Carolina; TABLE IX. indicates that there were 120,000 shellfishing households and 283,000 marine recreational shellfishermen in South Carolina during 1974.

Unpublished data from a 1975 NMFS survey (TABLE X) show that South Carolina anglers caught 8,804,000 finfishes. Among 35 species or species groups, most numerous were spotted seatrout, spot, croakers, all over one million; black seabass, red drum, kingfish (whiting), red snapper, and catfishes which numbered between 300,000 and 700,000; and weakfish, sheepshead, porgies, mullets, grunts, groupers, flounders, and bluefish, which ranged from 100,000 to 300,000.

TABLE VIII.

SOUTHEASTERN UNITED STATES MARINE RECREATIONAL FINFISHING
Estimated Number of Households and People Participating
by State of Residence
1974

State of Residence	Finfishing Households	Participants
	- - - - - -Thousands- - - - - -	
Alabama.	193	442
Florida.	954	2,101
Georgia.	258	557
Louisiana.	231	606
Mississippi.	122	285
North Carolina	502	1,120
South Carolina	185	396
Texas.	689	1,729
Total	3,134	7,236

TABLE IX.

SOUTHEASTERN UNITED STATES MARINE RECREATIONAL SHELLFISHING
Estimated Number of Households and People Participating
by State of Residence
1974

State of Residence	Shellfishing Households	Participants
	- - - - - - Thousands - - - - - -	
Alabama.	92	239
Florida.	419	989
Georgia.	108	251
Louisiana.	209	609
Mississippi.	64	183
North Carolina	179	445
South Carolina	120	283
Texas.	360	1,062
Total	1,551	4,061

TABLE X.

ESTIMATED NUMBER OF FINFISH CAUGHT (1) BY MARINE RECREATIONAL FISHERMEN (2) BY SPECIES GROUP AND STATE OF CATCH, 1975

(Southeastern Region)

Species Group (2)	STATE									
	North Carolina	South Carolina	Georgia	Florida East Coast	Florida West Coast	Alabama	Mississippi	Louisiana	Texas	Total
	Thousands									
Bass, black sea.	670	709	143	(3)	(3)	-	(3)	(3)	-	2,437
Bluefish	1,465	141	(3)	636	(3)	126	16	265	(3)	2,726
Catfishes.	(3)	302	183	2,094	2,402	253	221	1,490	2,019	8,965
Cobia.	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	147
Croakers	3,178	1,002	955	1,172	2,262	507	759	4,486	3,945	18,266
Dolphins	(3)	(3)	-	559	-	(3)	(3)	(3)	-	735
Drum, black.	(3)	17	510	(3)	(3)	(3)	(3)	553	410	1,828
Drum, red.	136	511	403	600	1,996	110	258	3,645	2,504	10,163
Eel, American.	(3)	21	(3)	(3)	(3)	(3)	20	(3)	(3)	146
Flounders.	1,218	146	101	106	223	57	126	333	1,182	3,492
Groupers	(3)	106	(3)	1,370	2,364	(3)	(3)	(3)	(3)	4,012
Grunts	(3)	139	(3)	2,814	2,663	(3)	(3)	(3)	(3)	5,779
Jacks.	(3)	(3)	(3)	535	1,408	52	(3)	83	73	2,250
Kingfishes	645	552	118	649	1,086	324	444	(3)	1,424	5,258
Ladyfish	-	(3)	(3)	(3)	380	(3)	(3)	(3)	(3)	628
Mackerel, king	150	29	(3)	(3)	196	137	(3)	38	140	1,015
Mackerel, Spanish.	377	95	(3)	261	2,260	380	225	147	(3)	4,549
Mackerels and Tunas.	(3)	(3)	(3)	162	(3)	35	(3)	(3)	(3)	356
Mullets.	(3)	166	(3)	933	2,988	270	698	(3)	(3)	6,144
Perch, silver.	(3)	(3)	-	(3)	(3)	(3)	(3)	443	(3)	1,033
Pompanos	(3)	(3)	-	(3)	(3)	(3)	-	(3)	(3)	563
Porgies.	479	254	-	1,401	1,824	100	(3)	(3)	(3)	4,302
Puffers.	37	(3)	(3)	(3)	268	(3)	(3)	(3)	(3)	657
Seatrout, sand	-	-	-	-	543	318	336	719	4,266	6,182
Seatrout, spotted.	131	1,782	1,403	1,668	6,414	606	1,375	11,005	5,332	29,716
Sheepshead	(3)	107	120	1,682	1,909	36	37	229	976	5,139
Sharks	60	88	16	157	73	52	20	123	91	680
Skates and Rays.	13	51	(3)	(3)	84	(3)	(3)	(3)	(3)	242
Snapper, red	(3)	341	(3)	654	2,122	154	(3)	848	206	4,475
Snappers	(3)	86	(3)	8,662	2,637	(3)	(3)	(3)	(3)	11,867
Snook.	-	-	-	266	511	-	-	-	-	777
Spot	5,981	1,679	122	663	(3)	(3)	-	-	-	8,551
Triggerfishes.	-	(3)	(3)	(3)	(3)	(3)	-	(3)	(3)	146
Weakfish	898	101	202	(3)	-	-	-	-	-	1,247
Miscellaneous.	786	270	345	589	1,280	269	359	507	406	4,811
Totals	16,766	8,804	5,126	29,180	39,483	4,112	5,133	25,492	25,188	159,284

(1) Row totals are given for species groups reported caught on at least 30 questionnaires throughout the region. An entry in a State column reflects a species group reported caught on at least 10 questionnaires throughout the State, however, the column total contains the total catch for all species groups reported caught within the State waters. A dash represents no reports of a species group in a State, and (3) represents a species group reported caught on less than 10 questionnaires in a State.

(2) A Scientific Name Index is contained in Appendix C.

Note:--Severe methodological problems caused the standard error of estimates to exceed normal reporting limits. The above data should be used with caution.

The most recent Marine Recreational Fisheries Survey, November 1978 to October 1979, in which South Carolina DMR personnel participated, provides somewhat smaller regional and South Carolina totals of recreational fisheries catch. TABLE XI shows the South Atlantic (North Carolina to Florida) landings to be 62,350,000 fish (a 1970 NMFS survey of this same area indicated the regional catch was 184,177,000 fish (see TABLE XII); and the South Carolina catch to be 2,440,000 fish, the principal species (those over 30,000) are sea bass, bluefish, catfish, croaker, red drum, flounder, kingfish (whiting), sharks, sheepshead, red snapper, spot and toadfish.

Further information on current marine recreational fisheries resources updating Bearden's 1969 report is provided by Cupka (1979) including data on types of activities, participation, localities, expenditures, harvest, and economic importance (see APPENDIX V).

Beyond what little information was provided by the Committee of Consultants in the 1968 report on the status of aquaculture and experimental pond culture in the development of South Carolina's marine resources, today the MRRI provides mariculture projects on several aspects of oyster culture, raft and bottom cultured hard clams, commercial shedding of blue crabs, extensive and intensive culture of Malaysian prawns, spawning and culture of Atlantic sturgeon, and pen culture of striped bass-white bass hybrids. The potential for raising and stocking red drum for impoundment fishing is considered.

From all these data, it must be concluded that the living marine resources of South Carolina, while substantial and increasing enormously

TABLE XI.

ESTIMATED TOTAL NUMBER OF FISH CAUGHT BY MARINE RECREATIONAL FISHERMEN BY SPECIES GROUP AND SUBREGION

(November 1978 - October 1979)

SPECIES GROUP	NORTH ATLANTIC	MID ATLANTIC	SOUTH ATLANTIC	GULF	ALL REGIONS
			THOUSANDS		
1. BARRACUDAS	*		389	38	449
2. BASSES, SEA	339	2,017	3,466	3,015	8,838
3. BLUEFISH	4,824	14,610	1,911	1,773	23,119
4. BLUE RUNNER	*	*	384	496	880
5. BONITO, ATLANTIC	34	333	48	142	556
6. CATFISHES, SEA	-	216	3,659	15,700	19,576
7. CATFISHES, FRESHWATER		154	*	91	269
8. COD, ATLANTIC	2,627	*	*	*	2,627
9. CROAKER, ATLANTIC	*	1,719	3,474	12,677	17,870
10. CUNNER	2,077	1,220	*	*	3,296
11. DOLPHINS	*		3,066	54	3,129
12. DRUM, BLACK	*	-	228	1,180	1,413
13. DRUM, RED	*	*	281	2,216	2,497
14. DRUMS	*		133	388	525
15. EEL, AMERICAN	113	172	49	54	388
16. FLOUNDERS, SUMMER	571	12,648	919	2,366	16,504
17. FLOUNDER, WINTER	12,295	8,392	*	*	20,687
18. FLOUNDERS	519	668	38	482	1,706
19. GROUPERS	*	*	548	492	1,040
20. GRUNT, WHITE	*	*	836	2,876	3,712
21. GRUNTS	*		1,864	1,647	3,510
22. HAKES	55	289		*	352
23. HERRINGS	795	240	2,647	2,136	5,818
24. JACK, CREVALLE	*		288	1,168	1,459
25. JACKS	*	51	713	890	1,654
26. KINGFISHES	*	31	931	5,081	6,043
27. LADYFISH	*	*	88	1,064	1,152
28. LITTLE TUNNY	*		200	150	370
29. MACKEREL, ATLANTIC	2,170	1,872	*	*	4,042
30. MACKEREL, KING	*	-	374	598	975
31. MACKEREL, SPANISH	*	*	124	1,287	1,410
32. MACKERELS AND TUNAS	119	131	114	144	508
33. MULLETS	*		7,589	5,003	12,603
34. PERCH, SAND	*	*	135	1,633	1,768
35. PERCH, SILVER	*	-	215	1,228	1,456
36. PERCH, WHITE	143	5,172	67	*	5,381
37. PERCH, YELLOW	*	250	*	*	250
38. PIGFISH	*	-	181	1,326	1,522
39. PINFISH			5,948	9,315	15,283
40. POLLOCK	2,088	270	*	*	2,358

TABLE XI (continued)

SPECIES GROUP	NORTH ATLANTIC	MID ATLANTIC	SOUTH ATLANTIC	GULF	ALL REGIONS
			THOUSANDS		
41. PORGIES	215	2,883	261	174	3,533
42. PUFFERS		90	399	237	728
43. SCUP	4,581	2,980			7,566
44. SEAROBINS	462	2,502	616	121	3,701
45. SEATROUT, SAND	*	*	_	5,318	5,322
46. SEATROUT, SILVER	*		512	222	744
47. SEATROUT, SPOTTED	*	410	3,549	15,361	19,320
48. SHARKS		702	451	851	2,007
49. SHARKS, DOGFISH	156	620		116	921
50. SHEEPSHEAD	*	*	860	2,818	3,677
51. SKATES AND RAYS	178	587	177	543	1,484
52. SMELTS	412	*	*	*	412
53. SNAPPER, GRAY	*	*	502	700	1,202
54. SNAPPER, RED	*	*	538	2,944	3,482
55. SNAPPER, VERMILLION	*	*	171	358	529
56. SNAPPERS	*		2,140	782	2,943
57. SPADEFISH, ATLANTIC	*	*		441	452
58. SPOT	*	8,656	7,824	605	17,084
59. STRIPED BASS	185	735	44		969
60. TAUTOG	989	1,752	_	*	2,741
61. TOADFISHES		754	339	251	1,345
62. TOMCOD, ATLANTIC	789		*	*	790
63. TRIGGER AND FILEFISHES		37	290	494	825
64. WEAKFISH	59	4,227	125	*	4,410
65. WINDOWPANE	76	368	*	*	443
66. OTHER FISH	2,447	1,440	2,403	3,589	9,880
TOTALS	39,356	79,342	62,163	112,646	293,508

NOTE: AN ASTERISK (*) DENOTES NONE REPORTED.

NOTE: AN UNDERSCORE (_) DENOTES LESS THAN THIRTY THOUSAND REPORTED. HOWEVER, THE FIGURE IS INCLUDED IN ROW AND COLUMN TOTALS.

TABLE XII.

ESTIMATED NUMBER OF SALTWATER ANGLERS AND THEIR CATCHES IN THE UNITED STATES IN 1960, 1965, and 1970
(by Survey Region)

Region	Number of anglers			Number of fish caught			Weight of fish caught		
	1960	1965	1970	1960	1965	1970	1960	1965	1970
	Thousands						Thousand pounds		
I. North Atlantic (New England and New York)	1,160	1,530	1,666	97,383	172,660	117,014	183,740	316,360	267,451
II. Middle Atlantic (New Jersey to Cape Hatteras)	1,344	1,375	1,767	114,502	92,126	168,209	178,000	128,288	246,267
III. South Atlantic (Cape Hatteras to Florida Keys)	1,024	1,720	1,808	156,942	190,802	184,177	370,112	391,833	403,913
Gulf of Mexico[1/] (Florida West Coast to Texas)	1,412	--	--	184,582	--	--	411,110	--	--
IV. East Gulf of Mexico (Florida West Coast to Mississippi River)	--	1,234	1,478	--	104,551	188,888	--	187,957	334,120
V. West Gulf of Mexico (Mississippi River to Texas)	--	738	872	--	89,550	97,708	--	187,618	151,608
VI. South Pacific (Pt. Conception South)	687	978	894	50,064	48,542	37,221	154,120	176,828	94,234
VII. North Pacific (Pt. Conception North)	714	999	1,311	29,399	38,508	24,100	83,219	85,469	79,230
ALL REGIONS	6,198[2/]	8,236[2/]	9,392[2/]	632,872	736,739	817,317	1,380,301	1,474,353	1,576,823

1/ The Gulf of Mexico was not separated into East and West sampling regions for the 1960 Angling Survey.
2/ These figures are less than the sum of anglers for the individual regions because some anglers fished in more than one region.

ltd resources

in value, are not infinite. The traditional inshore commercial species are all probably at maximum utilization and need careful planning and management to maintain their present levels of productivity or to increase. There do not appear to be substantial underutilized inshore species so increased landings will depend on offshore fisheries for bottom and pelagic finfish, mollusks, and crustacea. Recreational fisheries will continue to expand and while there is a large variety of resources available to this sector of the fisheries, they will be competitive with some commercial fisheries and put considerable pressure on certain select species.

How do deal w/ this in — mgmt sense

Mgmt Mechanisms / Techniques
Infrastructure?
State Agency Relationships?
Nature of Commercial vessels / needs

III. THE PAST DECADE OF GROWTH AND DEVELOPMENT*

Charge

The Marine Resources Division has now completed a decade of growth and development, and is now entering the decade of the 1980's. The Commission's charge to the present Committee was to first review the past decade of growth and development with respect to several specific areas. Were the original goals and program areas realistic ones for the seventies? Have those goals been followed reasonably well? Has reasonable progress been made towards achieving these goals? Has the staff been developed in a fashion consistent with the recommended program areas? Is the quality of the staff and the quality and productivity of the program such that the Commission can justifiably take pride in the Division and its operation?

Organization

In its "Report of the Marine Resources Study Committee to the South Carolina Wildlife Resources Commission" dated November 27, 1968, the Study Committee stated:

> "To wisely manage its marine resources, the State needs a marine resources management and development system consisting of several functional units. These are: a) Division of Marine Resources, b) Office of Marine Conservation Management and Services, and c) Marine Sciences Programs."

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* APPENDIX VII contains "A Summary History of the South Carolina Division of Marine Resources and Marine Resources Center, South Carolina Wildlife and Marine Resources Department" through November 18, 1977.

From Figure 1, it can be seen that the present organization is basically the same as that recomended in 1968. The only apparent differences are (1) in the Office of Marine Conservation, Management and Services, the word "Marine" was dropped and "Marketing" has replaced "Services," (2) the establishing of an Advisory Board to the Division of Marine Resources, and (3) the establishing within the Division of Marine Resources of a section for Administration and Vessel Operations. The present Study Committee unanimously agreed that these are all positive steps toward improving the program.

Division of Marine Resources (DMR)

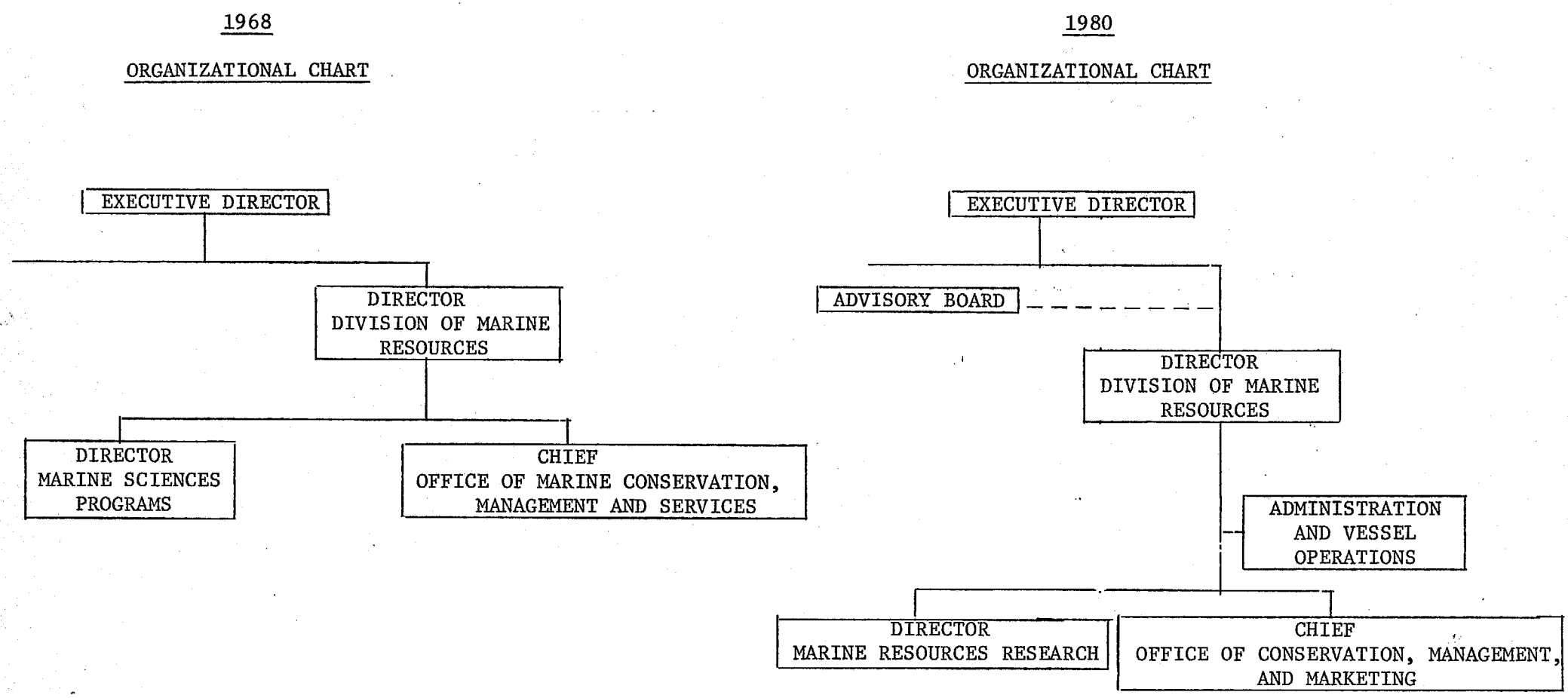
The 1968 Study Committee stated that the following duties might be assigned to the DMR:

"1. General supervision of marine resources programs.
"2. Liaison with higher authority.
"3. Coordination of subordinate units.
"4. Support subordinate units.
"5. General supervision of subordinate units.
"6. Responsibility for enforcement liaison.
"7. Public relations."

On July 18, 1969, the DMR was created by internal reorganization by the South Carolina Wildlife Resources Commission acting under authority prescribed by law (Section 28-97). The DMR was charged with the responsibility to insure the orderly development and conservation of the marine resources of South Carolina through planning, research, public education and management. In so doing, the DMR was charged with considering the social and economic welfare of future generations as well as the present well-being of the citizens of South Carolina. The DMR, in addition to its administrative section, contained two organizational units--the Office of Marine Conservation, Management and Services and the South Carolina Marine Research Laboratory.

FIGURE 1

ORGANIZATIONAL STRUCTURE OF DIVISION OF MARINE RESOURCES 1968 COMPARED WITH 1980



Presently, the DMR of the South Carolina Wildlife and Marine Resources Department (WMRD) is the branch of State government specifically charged with the responsibility of maintaining and enhancing the marine resources of the State. Greatest emphasis is being placed on the traditional species that make up the recreational and commercial seafood catch, however, all marine resources are the concern of the DMR. According to the "Report of South Carolina Wildlife & Marine Resources Department, July 1, 1978-June 30, 1979," "The Division's principal mission continues to be the development of a sufficient understanding of the living and non-living marine resources to allow the Division to provide wise management policies on behalf of the citizens of the State."

Office of Conservation, Management, and Marketing (OCMM)

In 1968, the Study Committee suggested that the following duties be assigned to the Office of Marine Conservation, Management and Services:

"1. Supervision of leases and permits.
"2. Supervision of repletion activities.
- o Shell plantings, seed plantings, and similar activities.

"3. Surveying and engineering.
"4. Other conservation services.

When the DMR was created on July 18, 1969, the Office of Marine Conservation Management and Services was charged with:

"1. Regulating and managing all saltwater fishing and fisheries in the tidal waters of the State, including: the regulation and control of fishing seasons, areas, catch, and gear; and the leasing of coastal bottoms for shellfish culture, mariculture, etc; and the issuance of special permits for the collection of marine and estuarine fish, shellfish and crustaceans.

"2. Administering the sale and issuance of fishing licenses, leases and permits, collect fisheries license and tax revenues and maintain records and statistics on fisheries revenue, landings and value.

"3. Conducting investigations and surveys of coastal waters, bottoms and associated living resources to provide information and recommendations concerning the use of these resources and to assure that public rights related to fishing and fisheries are not violated through alteration or degradation of the coastal environment."

In May of 1978, this office was assigned an additional major responsibility; namely, the creation and development of a Seafood Marketing Services Section. At that time, to reflect this new assignment, the name of the office was changed to the Office of Conservation, Management, and Marketing (OCMM).

Presently, the OCMM has the primary responsibilities for management and development of the commercial and recreational fisheries in the coastal area, including the regulation and control of commercial fishing seasons, areas, and equipment; the issuance of licenses and permits for fishing, management of public shellfish grounds; maintaining records of fisheries statistics, the leasing of State bottoms for shellfish culture or other forms of mariculture; the promotion of seafood products, and the development of seafood markets. The OCMM has also become increasingly active in a broad spectrum of environmental and ecological concerns, especially those which impact on fisheries and marine habitats.

Marine Resources Research Institute (MRRI)

The 1968 Study Committee recommended a separate functional unit outside the university apparatus to be responsible for the marine science programs, and suggested that this unit might embrace:

> "Applied and basic research; research services to marine industries and to Division of Wildlife Resources and other State agencies; technical consultation with executive and legislative agencies; coordination with other scientific activities such as Bears Bluff Laboratories, Inc., and with other State and Federal agencies; supervision of educational activities of the program; and coordination with higher education institutions."

On July 18, 1969, the South Carolina Marine Research Laboratory was created and charged with:

"1. Conducting research on all phases of the marine, estuarine and coastal fisheries of the state and on those species of organisms that support or influence such fisheries. Such research may include, but is not limited to biological investigations, harvesting and processing technology, and fishery socio-economic and marketing investigations.

"2. Conducting research leading to the development of mariculture as a viable enterprise in South Carolina. Such research may include, but is not limited to, mariculture technology, culture of marine and estuarine organisms, selective breeding, animal disease, food and nutrition, and the economic aspects of mariculture.

"3. Conducting environmental studies in estuarine and coastal environs and in the contiguous waters of the Atlantic Ocean. Such studies may include biological, physical, chemical and geological aspects and in addition shall include economic and societal considerations. The estuarine wetlands and nursery grounds of South Carolina are recognized as requiring special consideration in such studies and investigations.

"4. Conducting investigations of the physical processes in the marine and estuarine environment that have a bearing on the living or non-living marine resources of South Carolina. Such processes include, but are not limited to erosion, siltation, and sedimentation.

"5. Providing to the maximum extent possible physical facilities at the Marine Resources Center for the public colleges and universities of South Carolina in support of their graduate education programs in the marine sciences, and further, to engage in cooperation with the colleges and universities in research in the marine sciences as may be deemed appropriate."

Following the death of Dr. G. Robert Lunz, Director of Bears Bluff Laboratories in 1969, pond culture and other State marine research and management work at the Laboratories was shifted to the DMR of the South Carolina WMRD located at Fort Johnson, Charleston.

On October 19, 1973, under Departmental reorganization, the Marine Research Laboratory became the MRRI still within the DMR.

Presently, according to the "Report of South Carolina Wildlife & Marine Resources Department, July 1, 1978-June 30, 1979," the missions of the MRRI are:

"1. to provide research capabilities for the Department that will enable it to better manage the coastal resources of South Carolina;

"2. to provide marine research expertise for state government that can be called upon whenever coastal problems arise; and

"3. to provide a coordinating mechanism, seaside facilities, and a physical outlet to the sea for marine science interests and programs in all the State's educational institutions."

Staffing and Financial Support

The 1968 Study Committee recommended that:

> "The marine sciences programs operation must be adequately organized and staffed and provided with sufficient facilities and long-range financial support. Personnel should include a Director and Assistant Director and six other scientists. These should be supported by a cadre consisting of a business officer, several technicians, three clerks, a librarian, and several maintenance and vessel operations people."

As stated previously, the South Carolina DMR was created by the South Carolina Wildlife Commission on July 18, 1969. On March 20, 1970, Dr. James A. Timmerman, Jr., Head of the Biology Department at the Citadel, was hired as Director of the DMR. During September 1971, Dr. Edwin B. Joseph, Assistant Director of the Virginia Institute of Marine Science, was employed as Director of the Marine Research Laboratory. In February 1972, the first members of the scientific staff, Dr. V.G. Burrell, Jr., and Dr. P.A. Sandifer, arrived to join Dr. Joseph and began work at the Marine Research Laboratory, which was still under construction. By June 30, 1973, the end of the Marine Research Laboratory's first fiscal year of operation, the staff of the Laboratory had grown to 10 scientists and 29 support personnel, 22 of which were supported by grant and contract funds. On October 19, 1973, under Departmental reorganization, the Marine Research Laboratory became the MRRI. At the same time, Dr. Edwin B. Joseph was named Director of the DMR, replacing Dr. James Timmerman who was designated Deputy Executive Director of the WMRD.

Dr. V.G. Burrell, Jr., was promoted to Assistant Director of the MRRI and was named Director in February 1974. Dr. Timmerman became Executive Director of the WMRD on November 1, 1974.

On November 18, 1977, the Cooperative Research Facility of the MRRI was dedicated in honor of Dr. James A. Timmerman, Jr. This marked the beginning of "full utilization" of this facility by the MRRI and the State institutions of higher education. In addition to laboratories and offices for the MRRI, this building contains offices and work space for graduate students in the marine science program of the Charleston Higher Education Consortium (CHEC), dedicated space for the marine biomedical programs of the Medical University, classroom and laboratory space for the use of any of the State supported institutions of higher education, and a variety of common use areas such as a large auditorium, library, and canteen.

In 1968, the Study Committee stated "Sufficient long-term, State-provided financial support is required and justified. Arrangements should be made to allow and encourage utilization of funds from other State agencies, the Federal Government, foundations and industry."

Table XIII contains a summary of the Marine Research Laboratory's (now the MRRI) annual budget and staffing from 1973 through 1980. Table XIV contains the sources of funding annually for the MRRI for 1973 to 1980. According to the "Report of South Carolina Wildlife & Marine Resources Department, July 1, 1978-June 30, 1979," the staff of the MRRI for 1978-1979 consisted of 17 doctoral level positions which included an economist, a geologist, a computer specialist, as well as traditional chemists and biologists. Support personnel now number 56 with summer aides and hourly employees augmenting this group during some seasons.

TABLE XIII

ANNUAL BUDGET AND STAFFING OF THE MARINE RESOURCES RESEARCH INSTITUTE
1973-1980

Date	Annual Budget	Scientific Budget	Support Staff	Total
June 30, 1973	504,212	7	10	17
June 30, 1974	855,759	11	37	48
June 30, 1975	953,287	15	49	64
June 30, 1976	1,059,163	15	47	62
June 30, 1977	1,247,120	17	50	67
June 30, 1978	1,214,527	17	50	67
June 30, 1979	1,561,077	15	66	81
June 30, 1980	1,457,808	17	63	80

TABLE XIV

SOURCES OF FUNDING FOR MARINE RESOURCES RESEARCH INSTITUTE
1973-1980

Date	State Agencies (including MRRI and Others)	Federal Agencies	Foundations	Industry	Total
June 30, 1973	369,840	134,372			504,212
June 30, 1974	358,640	497,119			855,759
June 30, 1975	361,112	592,175			953,287
June 30, 1976	413,540	643,903		1,720	1,059,163
June 30, 1977	421,519	825,601			1,247,120
June 30, 1978	409,270	805,257			1,214,527
June 30, 1979	521,515	985,412	42,000	12,150	1,561,077
June 30, 1980	521,515	936,293			1,457,808

The staff of the OCMM, 24 biologists and 16 full-time support personnel, includes people with expertise in fisheries management, ecological evaluation, cartography, and marketing.

Facilities

In 1968, the Study Committee recommended that a modern, fireproof, seaside laboratory be obtained. Further, the Study Committee stated "Should new construction be necessary it will probably require $350,000-$400,000 to provide a building of the necessary characteristics. The initial cost of laboratory equipment required will probably be $100,000 to $150,000. Two small boats will be needed. The boats and associated trailers and trucks will cost about $20,000. The larger vessel and its associated dock and warehouse facilities will be about $150,000 and $20,000, respectively."

During the decade of the 1970's, the DMR acquired the following facilities:

A. 1. Two buildings were completed in 1972 at Fort Johnson on Charleston Harbor.

   a. An administration office complex housing the Office of Conservation, Management, and Services as well as DMR administrative personnel.

   b. A laboratory building housing the Marine Research Laboratory--renamed the South Carolina MRRI.

   2. Since then several existing building on the property have been renovated for use by the DMR.

   3. A cooperative Research Facility completed in 1977. This provides space for the College of Charleston graduate students, the Medical University of South Carolina Biomedical Program, marine related programs of other state institutions as well as much needed additional room for the MRRI program. Total laboratory space is now in excess of 60,000 square feet.

   4. A boat slip to moor the DMR's vessels which include: a 10-foot sea-going fisheries research vessel, the R/V DOLPHIN; the 72- foot R/V ATLANTIC SUN, a near-shore fisheries research vessel; the 55- foot R/V ANITA and 52-foot R/V CAROLINA PRIDE, near shore and estuarine research vessels; and several smaller inboard and outboard craft. These vessels are made available to marine science programs of South Carolina colleges and universities.

B. A well-stocked Marine Resources library has been located at Fort Johnson.

C. A data processing center which utilizes the IBM 370 computer at the University of South Carolina as a host has been put into operation.

Laboratory Site Location

In its 1968 report, the Study Committee recommended the following general sites (in order of suitability according to the Committee's criteria) for a State marine research laboratory:

1. Charleston area
2. Beaufort area
3. Hilton Head

On December 19, 1969, funding was secured to build the Marine Resources Center at Fort Johnson, Charleston. Construction of the first phase began in 1971 and was completed in 1972. This included the Administration Building and the first section of the Marine Research Laboratory. The cost of this facility was a little over $2 million. This figure does not include the cost of the Maintenance Building ($60,000), the Waste Treatment Plant ($150,000) and the Power Plant ($221,000).

Construction of the Cooperative Research Facility was initiated during FY 1974-75 and completed in 1977 at a cost of approximately $2,081,546.

The Laboratory facility occupied by the NMFS, Southeast Fishery Center, was constructed during 1977 and completed in 1978 at a cost of $3,300,000.

Legislation

Finally, the 1968 Study Committee concluded: "Adequate legislation supporting establishment of this program and its continuation should be passed. In doing so, specific responsibility for marine sport fishing, marine minerals, supervision of engineering projects involving the bottoms, shorelines, marshes, beaches, and contiguous waters and bottoms, should be

supplied. Responsibilities for coordination with local and federal authorities and other State agencies must be provided."

Title 50 of the South Carolina Code of Laws gives the DMR of the WMRD jurisdiction for the management and conservation of all saltwater fish, fishing, and fisheries; all fish, fishing, and fisheries in all tidal waters of the State; and all fish, fishing and fisheries in all waters of the State whereupon a tax or license is levied for use for commercial purposes. This includes: all shellfish, crustaceans, diamond-back terrapins, sea turtles, porpoises, shad, sturgeon, herring, and all other migratory fish except rock fish (striped bass).

Conclusions and Recommendations

The Marine Resources Study Committee agreed that the original goals and program areas were realistic ones for the decade of the seventies, that the goals have been followed extremely well, that excellent progress has been made towards achieving these goals, and that the staff has been developed in a fashion consistent with the recommended program areas. It was agreed unanimously by the Study Committee that the State of South Carolina, including the Commission and the WMRD, can justifiably take pride in the quality and quantity of the DMR's work over the past decade. Also, it is generally acknowledged that the State of South Carolina Marine Resources Center, located at Charleston, South Carolina, is one of the finest state marine resource research, management, and development facilities in the United States. Further, the State of South Carolina is widely recognized for having an excellent staff that is developing one of the most outstanding and comprehensive marine resources programs in the United States.

This does not mean that there are no problems or challenges facing the South Carolina marine resources program, because there are.

The most serious problem identified by the Study Committee is the lack of sufficient, basic, State funding support for essential activities and capabilities. The 1968 Study Committee stated: "Outside funds should not supplant the required internal monies but should supplement them" and "Sufficient long-term, State-provided financial support is required and justified. Arrangements should be made to allow and encourage utilization of funds from other State agencies, the Federal Government, foundations and industry." Between 1973 and 1980, annual State funding for the DMR research program increased by only about $150,000 while annual Federal funding increased by more than $800,000. Thus, in reality, Federal funds have supplanted needed internal funding. This has caused cash flow and other problems which will be discussed in a later section of this report.

Recommendation III-A

The State of South Carolina should take immediate steps to obtain sufficient long-term, State-provided financial support for essential internal marine resources program activites and capabilities.

> NOTE: For optimum benefits to the State marine resources program, the Study Committee recommends a mix of approximately 65-70 percent State and 30-35 percent Federal funds. The Study Committee feels that when Federal funds exceed about one-third total funding, the State is no longer able to control its program for the best interests of its citizens.

* * *

Communications between the DMR and certain South Carolina commercial fishing interests have been identified as another problem area. This is a problem not unique to South Carolina but common to all State and Federal fish and game management agencies. It requires continuous effort to address problems as they arise. Recently, a liaison officer, attached to the Director's office, has been assigned the responsibility for coordinating communications between the South Carolina WMRD and the commercial industry. Although this is a major step toward improving communications, the Study Committee feels additional effort is needed and offers the following recommendation.

Recommendation III-B (Also, see pages)

> Two liaison officers, attached to the Director's office, should be assigned the responsibility of coordinating communications between the WMRD and the commercial and recreational fishing interests. One officer should be responsible for coordinating communications north of Charleston and the other for communications south of Charleston.
>
> NOTE: Additionally, the Study Committee firmly believes an active Marine Resources Advisory Board can serve as an effective liaison among the Wildlife and Marine Commission, the WMRD, the DMR, and representation of the public at large and the business and industry interests involved. The Study Committee is pleased to note that efforts have been made to improve participation of the members of the Advisory Board by Executive Order 80-34 which requires members to attend a minimum of 50 percent of the formally scheduled Board meetings or be replaced.

* * *

In South Carolina, there is an urgent need for fisheries management-oriented research. Such research and development projects are being financed

and/or conducted by the South Carolina Sea Grant Consortium, South Carolina Coastal Council and the South Carolina DMR. Due to the existing fragmentation in fisheries management research, it is important to avoid duplication of effort to prevent waste or unwise use of funds, and to ensure that the highest management priorities and needs are met in South Carolina.

Recommendation III-C

> Since the South Carolina WMRD, through the DMR, is the primary State marine research arm, it is recommended that all marine resources oriented research financed by Sea Grant or Coastal Zone Management funds in South Carolina be submitted to the South Carolina DMR for review, priority evaluation, and comment.

OK, but what are priority areas?

* * *

Since 1973, the South Carolina DMR's overall program has expanded considerably with personnel increasing five-fold and budget three-fold. During this same time, the South Carolina marine resources program became internationally prominent and active in many regional and national marine research and management activities. The Director of the DMR served as Chairman (1975-1977), Atlantic States Marine Fisheries Commission; Chairman (1977-78) and Member (1976-present), South Atlantic Fisheries Management Council; Director (1971-79), South Carolina Sea Grant Program; Chairman (1980) and Member (1976-present), Charleston Higher Education Consortium Executive Committee; and Secretary (1980), South Carolina Sea Grant Board of Directors.

Recommendation III-D

> To assure proper growth, development, and administation of the South Carolina DMR Program, it is recommended that a competent administrator be employed as Deputy Director, Division of Marine Resources (DMR).

* * *

Major revision of South Carolina marine fisheries laws should be considered during the next year, with emphasis being placed on: general format and organization; regional and national aspects; overlapping jurisdiction of marine and freshwater fisheries laws and regulations; the need for increased departmental regulatory authorization; and specific revisions of coastal fisheries laws.

Recommendation III-E

> Since many of South Carolina's marine fisheries laws are complicated, antiquated, and of dubious merit, it is recommended that a special committee or commission be established for the purpose of recodifying existing fisheries laws and regulations, and of substituting possible changes of benefit to the State's marine fisheries.

more specificity needed as to what exact problems are.

* * *

IV. THE DECADE OF THE EIGHTIES

Charge

The second phase of the charge was considered to be of even greater importance and future utility to the Commission. This phase deals with the decade of the eighties. The specific questions that were to be modified to meet the expected problems and opportunities of the eighties. What about program emphasis? Were some areas receiving relatively more emphasis than they appear to deserve while other areas were not receiving adequate attention? Did the Committee see program areas that may have been worthy at some point in the past but can no longer be justified? Does the internal organization of the Division appear reasonable in light of the mission and goals?

On June 9, 1980, at the first meeting of the Study Committee, Dr. Edwin B. Joseph presented his philosophy on fisheries management (APPENDIX VIII). Also, at this meeting, Dr. Joseph presented eight goals with supporting objectives which he and his staff had developed as the DMR's goals for the decade of the eighties.

The DMR's goals and objectives for the eighties are outlined as follows:

GOAL A. BROADEN THE BASE AND IMPROVE UTILIZATION OF WILD-STOCK FISHERIES.

Objective 1. Continue exploratory fishing efforts, seeking identification, assessment and development, as appropriate, of underutilized and non-utilized fishery resources. Emphasis to be place on:

a. Rock Shrimp

b. Scallops

c. Conchs

d. Tilefish and other deepwater demersal species

e. Others as identified.

Objective 2. Broaden marketing program to develop new and improved marketing channels and markets for traditional and non-traditional fishery resources.

a. Continue contact and work with harvesting, processing, wholesaling, retailing, and consumer segments of the seafood industry.

b. Broaden program to serve as a focal point for dissemination of information on harvesting gear, fishing methodologies, gear and processing technological advancements, vessel construction funds and financial sources for new and existing seafood industry participants.

c. Undertake the development of inland and out-of-state markets for South Carolina seafood products.

Objective 3. Concentrate on development of finfish fisheries with particular emphasis on:

a. Snapper/grouper resources

b. Swordfish

c. Estuarine species such as trout, channel bass, spot and mullet

GOAL B. DEVELOP MANAGEMENT PLANS FOR ALL MAJOR FISHERY STOCKS AND FISHERIES (COMMERCIAL AND RECREATIONAL) WHICH WOULD BENEFIT BY MANAGEMENT: AND IMPLEMENT, MONITOR, AND MODIFY SUCH PLANS AS APPROPRIATE.

Objective 1. Concentrate on plan development and implementation for those fisheries not covered under FCMA management. This would include:

a. Shellfish (oysters and clams)

b. Blue crabs

c. Estuarine and near-shore finfish such as flounders, trout, channel bass, spot, mullet, and anadromous species

Objective 2. Cooperate with Councils and other regional institutions on those fisheries stocks requiring regional managment.

Objective 3. Continue to develop and improve our fisheries statistics program so that harvest and effort data can be collected more completely, efficiently, and in a timely manner.

how used in mgmt.

GOAL C. PROMOTE FULLER DEVELOPMENT OF THE MARINE RECREATIONAL FISHERIES

Objective 1. Continue publication policy to inform public on use of recreational resources.

Objective 2. Continue development of artificial reef program with emphasis on development of inshore and estuarine reefs.

Objective 3. Explore means of improving access to recreational resources by shore based fishermen through such projects as State developed fishing piers, bridge catwalks, and shore access.

Objective 4. Develop expanded data base relative to harvests, participation rates, effort and socio-economic data on major segments of recreational fisheries.

Objective 5. Develop improved management system for public shellfish areas.

Objective 6. Improve recreational fishing opportunities through stock enhancement activities and stocking of coastal impoundments.

GOAL D. DEVELOP AQUACULTURE AS A VIABLE COMMERCIAL ENTERPRISE IN SOUTH CAROLINA.

Objective 1. Develop the Waddell Center into a recognized research and demonstration unit.

Objective 2. Continue to develop technology on high priority species.

a. Prawns.

b. Clams

c. Oysters

d. Red drum

e. Shrimp

what does it mean in terms of spending priorities for state $: habitat protection: location of facilities? all these objectives?

f. Scallops

g. Striped bass/hybrids

h. Eels

i. Others as identified

Objective 3. Examine institutional barriers to successful mariculture and attempt to remove those barriers.

GOAL E. INCREASE UNDERSTANDING OF THE COASTAL AND MARINE ENVIRONMENT

Objective 1. Continue studies on effects of dredging and dredge-spoil disposal.

Objective 2. Conduct special studies at request of State Coastal Zone Management Agency.

Objective 3. Continue studies on ecology of barrier islands

Objective 4. Continue studies of potential energy related impacts

Objective 5. Continue to work internally and cooperatively with State and Federal agencies on beach erosion problems and solutions.

Objective 6. Continue program of evaluation permits for coastal alterations.

GOAL F. PROVIDE LOGISTIC AND STAFF SUPPORT TO STATE COLLEGES AND UNIVERSITIES

Objective 1. Provide space in cooperative research facility.

Objective 2. Provide vessel support for research and training programs of colleges and universities.

Objective 3. Contribute to development of the Charleston Higher Education Consortium (CHEC) graduate program in marine science.

GOAL G. EDUCATE CONSTITUENCIES AND GENERAL PUBLIC ON MARINE RESOURCE MATTERS

Objective 1. Production of special publications for special interest groups.

Objective 2. Continue development of workshops on a variety of marine resource topics.

Objective 3. Continue to work with public schools on marine affairs education

Objective 4. Continue to provide speakers for clubs and associations

Objective 5. Develop public education monies in cooperation with I and PA Division.

GOAL H. MANAGEMENT OF COASTAL PROPERTIES OWNED OR OPERATED BY THE DEPARTMENT.

Objective 1. Capers Island.

Objective 2. Others as may be acquired.

* * *

The Study Committee felt it could best address the second phase of its charge by reviewing, evaluating and commenting on (with appropriate recommendations) both Dr. Joseph's management philosophy and the DMR's goals.

Although there was considerable discussion concerning Dr. Joseph's management philosophy, the Study Committee found no serious problems with it. It was generally agreed that fisheries management today centered around research, allocating the resource for the benefit of the people while protecting the resource (i.e., optimum yield), regulations, and law enforcement.

good sign

good sign

The 1980 Study Committee has reviewed the goals noted above and offers the following comments and recommendations.

GOAL A. BROADEN THE BASE AND IMPROVE UTILIZATION OF WILD STOCK FISHERIES

Objective 1. Continue exploratory fishing efforts, seeking identification, assessment and development, as appropriate, of underutilized and non-utilized fishery resources. Emphasis to be placed on:

a. Rock Shrimp

b. Scallops

c. Conchs

d. Tilefish and other deepwater demersal species

e. Others as identified.

Objective 2. Broaden marketing program to develop new and improved marketing channels and markets for traditional and non-traditional fishery resources.

a. Continue contact and work with harvesting, processing, wholesaling, retailing, and consumer segments of the seafood industry.

b. Broaden program to serve as a focal point for dissemination of information on harvesting gear, fishing methodologies, gear and processing technological advancements, vessel construction funds and financial sources for new and existing seafood industry participants.

c. Undertake the development of inland and out-of-state markets for South Carolina seafood products.

Objective 3. Concentrate on development of finfish fisheries with particular emphasis on:

a. Snapper/grouper resources

b. Swordfish

c. Estuarine species such as trout, channel bass, spot and mullet.

The Study Committee finds this goal appropriate and valid in its general concept for the decade of the eighties. Objectives 1 and 3 must be pursued if South Carolina's fisheries are to expand and develop to meet State and National nutritional, as well as recreational needs, and insure financial stability for the industry. Some modifications to the goal are necessary to make it realistic and to provide for a greater degree of success in its overall attainment. For example, some of the resources represented as in need of emphasis, for a variety of reasons, may not merit as high a degree of attention as others. Other resources under consideration may have potential, but at this time are dependent on and related to other areas of commerical development rather than the fishing effort itself. There are, of course, those resources, that, while new to South Carolina fisheries, are immediately acceptable, but will depend on additional assessment and/or improved fishing effort and technique and consequently should continue to receive a high degree of attention in all phases of harvest, development, and utilization.

Emphasis on certain species, unless addressed with minimal financial and personnel resources, will be wasteful through all stages of assessment, harvest, processing and marketing as well. Conchs are perhaps a good example. At this time, the total U.S. consumption is localized and minimal and there appears to be no sustained broad demand for this resource, either as a food item or other use. Special consideration of this resource, while it may be underused, is unwarranted. While there is good market demand for calico scallops at all times, the resource in South Carolina is unpredictable and therefore cannot support an established permanent fishery. Exploratory

fishing should enable South Carolina fishermen to exploit this short-lived species as quickly as concentrations are monitored. The snapper/grouper/red porgy complex and other deepwater demersal species such as tilefish and snowy grouper are in the category of ready acceptability, and the growth potential is there with continued emphasis on assessment and monitoring of the resource. The swordfish market is strong but this species can easily be overfished. Assessment should contribute to the development of a knowledgable management plan by the Regional Fishery Management Councils to provide a resource yield that makes a reliable and sustained contribution to South Carolina fisheries.

In a different category, the Study Committee finds other species that do merit attention and perhaps hold a potential for a future successful development. There are resources that currently are available but are of little economic value in their natural state. Other problems in fisheries development need to be resolved before these fisheries can be expanded; little tunny (false albacore) and other oceanic pelagics such as bonito and bluefish, and coastal mullet are good examples. It has been established that these underutilized species exist in considerable abundance and that harvesting on a commercial level would be successful. But in most cases this is not practiced or is of little value because no processing facilities exist to handle the harvest. And until research and technology are able to produce acceptable marketable products from these resources, no processing plant will be interested. Given these products, it is only a matter of time for the resources to be in demand. Available marketing assistance at that time would be an added incentive for commercial exploitation and development.

It is likely that the proposed Seafood Industrial Park at Beaufort, South Carolina, upon its realization as a total facility, will provide the basis for the growth of fisheries for other species which at present are lacking central distribution facilities, freezers, etc. In this group are the spot, mullet, snapper-grouper, tilefish, and bluefish. This is an objective of the Seafood Park, which will also provide a central market for incidental fish harvest resulting from trawling efforts. The Seafood Facility will provide the opportunity to establish processing operations for the fresh resource as well as cooperative marketing center for the various fisheries.

The Committee recognizes that certain resources need only technology and methodology to develop their growth potential. Should the shedder crab industry develop, processors and markets are readily available for soft-shell crabs. Also, eels, both live and cured, are in growing demand. The resource needs attention. The rock shrimp fishery merits top priority, and emphasis should be given this resource from survey and fishing effort through processing and marketing phases.

Conclusions and Recommendations

The Study Committee must concur with the DMR's selection of this goal. To paraphrase the need--until recently, the commercial fisheries of South Carolina had a very restricted resource base, almost totally dependent on oysters, shrimp, and blue crabs. The oyster industry continues to decline over the years, while the shrimp fishery is fully developed--the harvest fluctuating around a plateau while the number of vessels in the fishery expands. The blue crab fishery remains viable but is not likely to produce

vastly increased products. The only way South Carolina can increase its production of wild-caught resources is to broaden the fisheries base and harvest new species wherever they occur. This became a reality when the severe winters of 1976, '77, and '78 killed off the shrimp crop, and pointed out the great danger in dependence, so heavily, on one dominant fishery.

In addition to exploratory fishing, assessment, monitoring, and development of new resources, the Study Committee recognizes the importance of the South Carolina DMR to continue its contact and work with harvesting, wholesaling, retailing, and consumer segments of the seafood industry, offering technological expertise and consultation in a broad area of constituent needs and understanding, as circumstances warrant.

A comprehensive seafood marketing service will be an essential element in the expansion of the fisheries base and better utilization of products, particularly for new species and product development, and as a primary source of marketing information that will attract the interest, not only of the public, but those potential private industry representatives interested in the opportunities of the seafood industry. While there may be some question as to what extent the DMR should be involved in the development of out-of-state markets for South Carolina seafood products, particularly the established species, marketing and consumer education are an essential ingredient in the responsibility of a marine fisheries resource agency and especially committed where fisheries development is an established goal. The seafood marketing service of the DMR should be coordinated with those of other State and Federal agencies including the State Development Board, extension services, and the NMFS.

Recommendation IV-A-1

The Study Committee recommends that Objective 1 be modified as follows:

Objective 1. Continue exploratory fishing efforts, seeking identification, assessment, and market development, as appropriate, of underutilized and non-utilized fishery resources.

Emphasis to be placed on:

a. rock shrimp

b. little tunny (false albacore)

c. other species as appropriate.

Less emphasis to be placed on:

a. scallops

b. conchs

c. swordfish

d. tilefish and other deepwater demersal species.

Recommendation IV-A-2

The Study Committee recognizes that the present voluntary system of reporting landings figures is inadequate to base data needs, and the development of traditional and new fisheries. The Committee recommends a mandatory system, such as weigh-out record at first point of sale.

Recommendation IV-A-3

It is recommended that Objective 2.b. be modified to read as follows:

In cooperation with the South Carolina Sea Grant Marine Advisory Service serve as a joint focal point for dissemination of information on harvesting gear, fishing methodologies, gear, and processing technology advancements, vessel construction funds and financial sources for new and existing seafood industry participants.

GOAL B. DEVELOP MANAGEMENT PLANS FOR ALL MAJOR FISHERIES STOCKS AND FISHERIES (COMMERICAL AND RECREATIONAL) WHICH WOULD BENEFIT BY MANAGEMENT, AND IMPLEMENT, MONITOR, AND MODIFY SUCH PLANS AS APPROPRIATE.

Objective 1. Concentrate on plan development and implementation for those fisheries not covered under FCMA management.

This would include:

a. Shellfish (oysters and hard clams)

b. Blue crab

c. Estuarine and nearshore finfish such as flounders, trout, channel bass, spot, mullet, and anadromous species

Objective 2. Cooperate with Councils and other regional institutions on those fisheries stocks requiring regional management.

Objective 3. Continue to develop and improve our fisheries statistics program so that harvest and effort data can be collected more completely, efficiently, and in a timely manner.

Background

The marine and estuarine fisheries resources of South Carolina's coastal zone are extremely valuable to the people of the State, from an economic as well as a recreational standpoint. During 1979, a total of 21,450,000 pounds of seafood products valued at over $25,800,000 (dockside) were landed in South Carolina. The total economic impact of commercial fishing in South Carolina is estimated to be several times that figure, taking into consideration the wholesale and retail trade, seafood processing, and other factors. The coastal recreational fishery of South Carolina has become increasingly important in recent years, also. It is estimated that over 396,000 residents participate in coastal recreational fishing activities, and their annual

expenditures directly related to sport fishing amount to more than $50,000,000.

Increasing demands and fishing pressure by commercial and recreational interests have accentuated the need for sound management of coastal fisheries resources in South Carolina. In addition, alteration of the marine-estuarine habitat upon which coastal fisheries are dependent has increased considerably in recent years, further emphasizing the need for effective management and conservation of living marine resources. As the population of the coastal zone of South Carolina continues to grow and expand, the problems associated with the utilization of fisheries resources will intensify and become increasingly complex. It is, therefore, essential that the State of South Carolina develop comprehensive management plans for important coastal fisheries resources.

The DMR of the South Carolina WMRD is the State organizational unit having primary responsibilities for the management and conservation of the living resources of the coastal zone, especially marine and estuarine fisheries resources. These responsibilities are specified under State legislation (Title 50, South Carolina Code of Laws) which provides the DMR with jurisdiction over all fish, fishing, and fisheries in the saltwaters of South Carolina, including shellfish, crustaceans, finfish, sea turtles and marine mammals. Other legislation provides for the management and regulation of coastal and anadromous fisheries, including control of fishing seasons, areas and equipment; issuance of leases of State bottoms for shellfish culture and mariculture; and the issuance of licenses and permits for fishing activities. In addition, the DMR is active in environmental matters within

the coastal zone, including the investigation of fish kills, environmental research and monitoring, wetlands inventory, and the review and evaluation of environmental impact statements and State and Federal permit applications for coastal alterations. A major goal of the DMR is to manage and develop coastal fisheries resources, emphasizing maximum protection of the marine-estuarine environment, in such a manner as to provide for optimum sustained benefits to the people of the State.

The DMR has made significant advancements in the area of fisheries management and related research since it was created under Departmental reorganization in 1969. Prior to this time, the DMR's predecessor, the Division of Commercial Fisheries (DCF) and Bears Bluff Laboratories, conducted studies (chiefly survey and life history) of some coastal finfish, shrimp, and blue crab. In 1967 a recreational fisheries program was established within the DCF and a report including recommendations for needed research and management was submitted in 1969 to the Commission.

During the 1970's, the DMR expanded the fisheries management and related research program considerably. The recreational fisheries section within the OCMM was expanded and has conducted numerous investigations relative to management, including a survey of ocean pier fishing, marine gamefish tagging studies, and the collection of biological catch data from saltwater fishing tournaments. A commercial finfish management section was created within the OCMM in the mid-1970's, and this unit has conducted management investigations of coastal finfish, anadromous and catadromous fisheries, catch/effort and biological data collection from offshore snapper-grouper and swordfish fisheries. The DMR was also instrumental in the development of a regional

South Atlantic shrimp management plan, completed in 1975. This plan has been published and is being implemented by the four South Atlantic States (North Carolina, South Carolina, Georgia, and Florida). A cooperative State-Federal fisheries statistics program, involving the comprehensive collection of shrimp catch and effort data essential for management, is well underway as a result of this planning effort. This program has served to augment the DMR's ongoing fisheries statistics program begun in 1970 and funded under the P.L. 88-309 program. Also in the area of management planning, the DMR has developed a management plan for anadromous fishes (shad, striped bass, river herring) in cooperation with the State of Georgia under a P.L. 89-304 funded project.

In addition to shrimp and anadromous species, the major coastal fisheries resources found within waters are coastal finfish (particularly sciaenid fishes such as seatrout and drum, and flounder), blue crab, and molluscan shellfish (eastern oyster and hard clam). Management planning profiles, under a grant from the Coastal Fisheries Assistance Program (CFAP), were developed for these fisheries in 1979.

Shellfish management activities were expanded in the 1970's and included a survey of the State's hard clam resources, which led to the development of a managed fishery in the Santee estuary. An improved shellfish leasing program was also developed. The crustacean management program (shrimp and blue crab) was also expanded considerably during the 1970's. In the area of fisheries management related research, the DMR established an estuarine survey program during the early 1970's which included the collection of biological data on coastal finfishes. The Marine Resources Monitoring Assessment and Prediction Program (MARMAP), initiated in the 1970's, has provided much information on

the fisheries resources of the continental shelf off South Carolina and adjacent states. Studies of the incidental catch of underutilized fishes were also conducted.

Status

Currently, the South Carolina DMR is involved in a number of programs and projects pertinent to the attainment of GOAL B. Many of the activities are in line with recommendations made in the management plans and profiles developed in previous years.

Within the OCMM, the Commmercial Fisheries Management Section (CFMS) is conducting a continuing program funded under P.L. 89-304 for the monitoring and assessment of the commercial fishery for American shad. This project is aimed at providing catch/effort and biological information pertinent to future management of the fishery. The CFMS is also continuing to collect data from the commercial snapper-grouper fishery, which is made available to the South Atlantic Regional Fishery Management Council.

The shellfish management section of the OCMM is currently engaged in a comprehensive survey of the State's intertidal oyster resources under a CFAP grant. This survey is felt to be an essential step towards the development of a statewide oyster management program. Evaluations are also being made, in cooperation with the MRRI, of a newly developed mechanical harvester for intertidal oysters.

In the area of crustacean management, the OCMM is continuing its activities and surveys related to shrimp and blue crab management. Participation in the regional State/Federal shrimp management is also continuing.

In the recreational fisheries area, tagging studies, collection of biological and catch data, and angler survey activities are being continued by the OCMM. Expansion and improvement of the State's recreational shellfish management program is also well underway.

The OCMM's fisheries statistics program, funded under the P.L. 88-309 and State/Federal programs, has been expanded and has increased coverage of catch and effort data collection activities.

In the research area, the MRRI is continuing the MARMAP program, blue crab studies, investigations of Atlantic sturgeon and shellfish studies. Studies of juvenile snapper and grouper are underway, also. A major study of the live bottom habitat of the continental shelf, funded by the Bureau of Land Management was recently initiated and is providing considerable information concerning the biology, ecology, and behavior of commercially and recreationally important species. A survey to describe the abundance and distribution of underutilized species on the South Carolina continental shelf was initiated in 1980. In line with the coastal finfish managment profile, a study of sea trout and red drum is currently underway to determine catch, seasonal abundance, recruitment, age-growth, and other related parameters.

Comments and Recommendations

Goal B is extremely appropriate and one of the most important for the DMR to pursue during the decade of the 1980's. This goal is in keeping with the legislative mandate of the DMR and should receive very high priority in terms of emphasis. The continuation and expansion of the fisheries management and related research activities pertinent to the various objectives of this goal are essential to the DMR in order to carry out its statewide

responsibilities and are much needed to provide information to the South Atlantic Fishery Management Council and the State/Federal regional fisheries management program.

The need for comprehensive management plans is felt to be most critical for coastal finfish species such as spotted seatrout, red drum and flounder; catadromous and anadromous fishes; blue crab; and molluscan shellfish (hard clam, eastern oysters). These fisheries are all of considerable importance and are clearly in need of management due to increasing pressure by commercial and recreational fishing and/or various social or economic problems. Although the DMR has developed preliminary plans or profiles for these fisheries and has ongoing research projects pertaining to each, the development of long range, comprehensive management plans is felt to be critical within the near future.

Recommendation IV-B-1

Objective 1.c. should be modified to read as follows:

> Estuarine and hear-shore finfish such as flounder, trout, channel bass, spot, mullet, catadromous and anadromous species.

Recommendation IV-B 2

Objective 3 should be expanded to read as follows:

> Continue to develop and improve our fisheries statistics program so that harvest and effort data can be collected more precisely, accurately, completely, efficiently, and in a timely manner.

Recomendation IV-B-3

Objective 4, as follows, should be added to Goal B.

> Continue and expand research efforts to provide the information on life history, ecology, behavior, population dynamics, etc., that is essential to management, and to provide for subsequent monitoring and fine tuning of the management measures applied.

Recommendation IV-B-4

Expand the fisheries statistics program to improve sampling coverage of commercial fisheries and to include the collection and analysis of recreational fisheries catch and effort data.

Recommendation IV-B-5

Conduct periodic surveys and economic studies of commercial and recreational fisheries for use in the development and implementation of fisheries management plans. This would include the collection and analysis of data on participation, economic impact, catch, etc., of specific fisheries (blue crab, coastal finfish, etc.) as well as gear related fisheries (gill net, shrimp seine, etc.).

Recommendation IV-B-6

Continue, improve, and update surveys and assessments of fisheries resources; including: the monitoring of shrimp and blue crab populations for predictive purposes; molluscan shellfish surveys; penaeid shrimp harvest in territorial sea vs. FCZ; etc.

GOAL C. PROMOTE FULLER DEVELOPMENT OF THE MARINE RECREATIONAL FISHERIES

Objective 1. Continue publication policy to inform public on use of recreational resources.

Objective 2. Continue development of artificial reef program with emphasis on development of inshore and estuarine reefs.

Objective 3. Explore means of improving access to recreational resources by shore-based fishermen through such projects as State developed fishing piers, bridge catwalks, and shore access.

Objective 4. Develop expanded data base relative to harvests, participation rates, effort and socio-economic data on major segments of recreational fisheries

Objective 5. Develop improved management system for public shellfish areas.

Objective 6. Improve recreational fishing opportunities through stock enhancement activities and stocking of coastal impoundments.

Background and Status

It is becoming increasingly apparent that the marine recreational fisheries of South Carolina constitute one of the coastal area's most valuable assets. This is true not only from a recreational standpoint, but also in terms of the impact which these fisheries have on the coastal and State economies. Until relatively recently, activities directed at development and management of coastal fisheries in South Carolina have dealt primarily with commercial fisheries. It is now clearly evident, however, that marine recreational fisheries deserve considerably increased attention.

South Carolina is fortunate in having a variety of marine habitats which offer abundant marine recreational fishing opportunities to residents and visitors. These include vast networks of saltmarsh creeks, numerous inlets, large sounds, long stretches of beach and a large, relatively unexploited

offshore area. Estuarine habitat varies from high salinity, unstratified types of brackish water, stratified types where large freshwater rivers enter the coastal region, to low salinity water. The State has approximately 190 miles of coastline and 2876 miles of tidal shoreline. The total area available for saltwater sport fishing extends from Little River at the North Carolina line, southward to the Georgia line, and from the upper lmits of brackish water eastward to the Gulf Stream. Thousands of square miles of water area are accessible to offshore party and private sportfishing boats.

More than 400 species of fish inhabit the marine and estuarine waters of South Carolina and many of these are important to the recreational fisheries, either as species utilized directly by anglers, or as forage species for sportfish. In addition to these finfish resources, other species such as shrimp, crabs, oysters and clams form the basis of important recreational fisheries. The marine recreational fisheries of South Carolina can be classified by major types of activities which include surf fishing; pier and bridge fishing; inshore, inlet and sound fishing; offshore trolling; offfshore bottom fishing; artificial reef fishing; party boat fishing; shrimping; crabbing; and shellfish harvesting.

Surf fishing is a popular sport in South Carolina and perhaps has more to offer than any other type of saltwater fishing. One reason surf fishing is so popular is that it is readily accessible and requires little more than a suitable rod and reel, basic tackle and patience. Exceptional fishing from the mainland coast can be found along the Grand Strand area north and south of Myrtle Beach. Fishes taken along this stretch of gradually sloping beach are usually smaller species such as whiting, croaker, and spot. For the recluse

fishermen, isolated areas on Bull Island, Cape Island, Dewees Island and Morris Island are well-known for their fish-producing capabilities. Accessible only by boat, these barrier beaches provide excellent catches of red drum, flounder, bluefish, and sea trout. Further south, the beaches of Kiawah, Edisto and Hunting Islands offer even greater surf fishing opportunities for the family-style fisherman.

Pier fishing is an extension of surf fishing, and as a rule the same species are encountered as in surf fishing. Pier extensions, out to 1,000 feet or more from the beach, provide for more consistent catches of bluefish and Spanish mackerel which patrol these areas in search of bait fish. Sheepshead are frequently caught around the pier pilings along with black drum. The techniques of float fishing from piers and bridges have recently produced catches of cobia and king mackerel. There are eight ocean fishing piers located on the South Carolina coast, all of which are located between Murrells Inlet and Little River.

Many of the bridges located in the coastal area are used as fishing platforms, some of them incorporating specially constructed fishing catwalks.

Sportfishing opportunities inshore near the inlets and upstream in the coastal sounds and large brackish rivers are outstanding in South Carolina. This type of fishing is usually accomplished out of small boats or skiffs which can run the shallow flats. Winter trout, school bass (red drum), striped bass and flounder are the more popular species caught inside. Cobia, tripletail, Spanish mackerel, bluefish and an occasional tarpon are also caught inshore with regularity.

In terms of numbers of participants, the small boat fishery constitutes the largest segment of the marine recreational fishery. There are over 50,000 registered boats in the coastal counties of South Carolina, a large percentage

of which are used on occasion for saltwater fishing. In terms of support facilities for small boat anglers, there are 98 boat ramps and 40 marinas located within the coastal area.

The fish-rich continental shelf areas of South Carolina stretch far and wide to produce big gamefish for offshore fishermen. This bountiful area has only in the last decade been recognized as a fishing ground for the big blue water gamesters. Prior to around 1965 the local fishermen seeking adventure in billfish fishing went south to Florida or north to Hatteras. Since that time, billfish fishing has caught on in South Carolina, and fish such as blue marlin, white marlin, and sailfish are landed frequently every year.

Closer to shore, trolling is primarily aimed at catching Spanish and king mackerel, bluefish and jacks. Farther offshore in the deep, blue waters (10 to 60 miles out) of the Gulf Stream, trolling activities are directed towards the bigger game species such as dolphin, little tunny (bonito), amberjacks, barracudas, blackfin tuna, wahoo, sailfish, and marlin.

Offshore bottom fishing is a growing activity among private boat anglers. Species of primary importance to this fishery are black seabass, groupers, snappers, porgies and grunts. The principal areas fished are the "Blackfish Banks" (rough bottom areas composed of rock outcroppings and corals) located 5 to 20 miles offshore and the "Snapper Banks" (natural reef areas, rocky ledges, and drop-offs) which parallel the coast some 20 to 60 miles offshore.

There are 10 artificial fishing reefs currently located off the coast of South Carolina which provide easily located and productive fishing sites for offshore fishermen. These reefs, built and maintained by the South Carolina WMRD, consist of steel ship hulls, rubber tires and concrete rubble. They attract additional anglers to an area and provide increased fishing

opportunities. Species caught on the artificial reefs include king and Spanish mackerel, cobia, bluefish, black seabass, amberjacks, spadefish, flounder, trout, and sheepshead.

The reefs are also popular sites for spearfishing, underwater photography, and SCUBA diving to explore and examine the various forms of marine life present. There are nine dive shops located in the coastal area which depend, to varying degrees, upon the artificial reefs for a portion of their business.

Party boat fishing off the South Carolina coast has grown significantly within the last decade. There are two basic types of boats which constitute this segment of the fishery. The "headboat" generally carries from 40 to 100 people on a single trip and charges on a per-person-basis. Headboats fish primarily for those species mentioned in the discussion on offshore bottom fishing.

The second type, charter boats, usually carry four to six people and the boats charge a flat fee. Charter boats generally fish for the same species discussed earlier in relation to offshore trolling.

During 1980, there were 42 charter boats operating out of South Carolina ports which offered offshore trolling trips for anglers. The major charter boat centers were located at Little River, Murrells Inlet, Georgetown, Charleston, Fripp Island, and Hilton Head Island. There were 19 headboats providing offshore bottom fishing trips in 1980. These boats, which could carry from 24 to 118 anglers, operated out of Little River, Murrells Inlet, Charleston, and Hilton Head Island.

Recreational shrimping is best during late May through mid-October, although there is no legal season on shrimp except as applicable to trawling or towing a net by means of a boat having a motor. Practically all of the

tidal creeks throughout the coastal area provide excellent shrimping with cast nets, seines, or baited drop nets. Shrimping is carried on from bridges, small boats, or from the shore. The two common species of edible shrimp found in South Carolina are the brown shrimp (best season, late May through July) and the white shrimp (best season, late August through mid-October). The brown shrimp is usually more plentiful in high salinity areas closer to the ocean, whereas the white shrimp is most abundant in brackish water areas.

Crabbing is a favorite family recreational activity within the coastal areas of South Carolina. Although there is no closed season for recreational crabbing in the State, the best months are April through November. Crabs may be caught by a variety of methods, but those most commonly employed are baited drop net (herring or mullet bait), handline and dip net, or crab trap (pot). Crabs are plentiful throughout the State's coastal waters and may be caught from bridges, docks, the open beach, from shore or from a boat. A popular method for family crabbing is to set one or two commercial type traps in the area while crabbing with baited handlines.

The most popular shellfish sought by recreational sportsmen in South Carolina are the eastern oyster and the hard clam. The South Carolina WMRD maintains 30 coastal areas where the public can harvest shellfish. In addition, the public can harvest shellfish from leased commercial grounds provided they have written permission from the leaseholders. The quantity and quality of the shellfish in the public areas varies considerably.

During the reorganization of the South Carolina WMRD in 1973, a Saltwater Sport Fish Section was established in the OCMM, within the DMR. The Section was responsible for the management and development of the saltwater sportfish resources, primarily the finfish resources. During 1974, the responsibilities of the Section were expanded to include the management and

development of all marine recreational fisheries in South Carolina. To reflect this expansion of responsibilities and objectives, the name of the Saltwater Sport Fish Section was changed to the Marine Recreational Fisheries Section. In 1978, the recreational fisheries program was again expanded by the creation of an Artificial Reef Section and a Recreational Finfish Section within the overall program.

Recreational fisheries programs have operated on very restricted budgets ($15,870 during fiscal year 1976-1977; less than $19,000 during fiscal year 1978-1979; these figures are exclusive of salaries). However, a number of programs and services have been provided and a number of accomplishments made. The following summarizes these accomplishments as of October 1980.

One of the most important functions has been keeping South Carolina sportsmen aware of saltwater fishing activities that occur in the State, as well as those at the national and international level which affect saltwater fisheries. This has been accomplished through a bi-monthly newsletter, SALTWATER CONVERSATION, which is presently sent free of charge to over 15,000 individuals. Several guides and brochures such as "A Guide to Saltwater Recreational Fisheries in South Carolina", "The Angler's Guide to South Carolina's Artificial Reefs", "The Recreational Shellfish Guide", "A Field Guide to the Billfishes, Mackerels, Little Tunas, and Tunas in South Carolina", and an annual brochure of South Carolina's saltwater sportfishing tournaments and State record fish has been published in limited numbers. A 30-minute color movie concerning saltwater recreational fisheries in South Carolina has been produced. Talks, and this movie, are presented several times each month to sportfishing clubs, civic associations, and other groups.

A State record saltwater gamefish program has been developed with records maintained as to the largest (by weight) of each gamefish taken in

South Carolina. These fish are documented by fisheries biologists and a frameable certificate is presented to each angler setting a new State record. Monies donated by the South Carolina Saltwater Sportfishing Association were utilized to begin a gamefish tagging program in which tagging kits are given free to interested anglers upon request. An extensive fishing tournament program has been developed to aid various fishing clubs and organizations in setting up local and regional fishing tournaments. Section biologists also act as official weighmasters at such tournaments and record catch/effort and biological data from fish taken during these tournaments. A billfish program has been developed where biologists verify and document all billfish landed in South Carolina. A certificate program was instituted in January of 1979 in which all anglers landing a billfish received a frameable certificate attesting to their catch. Surveys, including a mail survey of recreational shrimping in South Carolina, an economic and biological evaluation of the South Carolina pier fishery, an economic study of South Carolina's artificial reefs, and a summer survey of recreational fishing in Murrells Inlet have been carried out during the past several years.

Thirty public oyster and State shellfish grounds located throughout the coastal area have been surveyed, signs posted, and a free guide published providing detailed maps of their exact location. Ten artificial reefs have been built or substantially added to with funds obtained from both the State and the Federal Government. The DMR has also been involved in facility development for recreational fishermen along the coast, such as catwalks, marina design and location, and the Murrells Inlet jetty walkway. The DMR was also instrumental in establishing and organizing the South Carolina Sportfishing Association in the late 1960's.

In 1980, the DMR's staff was composed of five biologists, a wildlife technician, and a secretary. As a result of an increased need for space, primarily as a consequence of the publication of two new recreational fisheries guides, all recreational fisheries personnel moved into the first floor of the Marshlands House located adjacent to the MRRI in January 1980. During the present fiscal year (1980-1981) recreational fisheries programs will operate on a budget exceeding $100,000 (exclusive of salaries and boat operations). The following outlines the status and objectives of these programs.

ARTIFICIAL REEF PROGRAM:

State funding ($7,000) is being utilized to replace lost and damaged reef buoys. As of October 1980, there were ten artificial reefs and eight fishing wrecks included in this program. An additional $23,000 (state funding) will be utilized for adding additional material to these reefs. An inshore fishing reef, the first estuarine reef in South Carolina, was built within the South Edisto River during October 1980 at a cost of $22,000. This experimental reef is constructed of concrete rubble, discarded tires and plastic pipe. These materials are being evaluated for utilization in the building of additional inshore reefs in the future.

An <u>in situ</u> tire unit stability evaluation study was scheduled to be conducted during the 1980-1981 fiscal year through the Sea Grant program, with $10,500 Federal funds and $14,500 State funds provided for in the proposal. A decision on this proposal was pending during October 1980.

The final report submitted by Roy F. Weston, Inc., (designers-consultants) concerning a "South Carolina Tire Disposal Feasibility Study,"

concluded that the 2.6 million scrap tires, which require disposal in South Carolina annually, be utilized in artificial reef construction off the South Carolina Coast, and that a Statewide artificial reef program be implemented for that purpose with the necessary funding being derived from a tax on new tires at purchase.

SHELLFISH PROGRAM

State funding ($30,000) is scheduled to be utilized to transplant oysters from polluted areas to several public oyster grounds during the 1980-1981 fiscal year. Transplanting of polluted oysters will be carried out following the close of the oyster season, April 30, 1981, so that they may depurate over the summer months. Other shellfish program activities include surveying State shellfish grounds in order to locate and establish additional recreational shellfish areas, and surveying existing public State shellfish areas for condition of the beds and maintenance of signs marking these areas. A survey to determine the magnitude of public shellfishing for private use on State shellfish and public oyster grounds was pending approval in October of 1980 through the CFAP. This survey would estimate the number of individuals who engage in shellfish harvesting, their annual catch, days harvested, and the areas utilized. Also, it was suggested that the DMR investigate the feasibility of utilizing the mechanical oyster harvestor being developed at Clemson University for maintaining the State's oyster grounds. It was also noted that a special State legislative shellfish committee has been appointed and is reviewing the problems and needs of the shellfish industry.

RECREATIONAL FINFISH PROGRAMS

The various established programs of this Section, such as the billfish survey and certificate programs, the tournament program, the State record

marine gamefish program, tagging kit program, and the collection of biological data on the various marine sportfish will be continued during the current fiscal year.

As of October 1980 a grant proposal was pending through the CFAP for the 1980-1981 fiscal year to conduct a survey of saltwater recreational fishing facilities and their access within the coastal zone of South Carolina.

PUBLIC LIAISON: SALTWATER CONVERSATION

This recreational fisheries newsletter has been budgeted ($12,000) to provide four issues of approximately 30 pages each during the 1980-1981 fiscal year. In cooperation with the WMRD's Information and Public Affairs Division (IPA), a color film, (approximately 18 minutes) on recreational gathering of South Carolina shellfish (oysters, clams, crabs, and shrimp), is scheduled to be produced.

Other public liaison activities include working closely with the various South Carolina saltwater sportfishing clubs, giving talks to civic and other interested groups, providing weekly fishing reports, setting up exhibits concerning recreational fisheries and working closely with newspapers, outdoor writers, and others in promoting South Carolina's recreational fisheries.

Information concerning South Carolina's recreational fishing continues to be provided through publications printed and distributed by the South Carolina Marine Research and Conservation Foundation. Two guides, "A Recreational Guide to Oystering, Clamming, Shrimping and Crabbing in South Carolina," of which 17,000 copies were sold between January and October of 1980, and "A Guide to Saltwater Recreational Fisheries in South Carolina," of which over 7,000 copies were sold between June and October of 1980, have established the demand for such information. Nearly 20 percent of the mail

orders for these guides have come from States other than South Carolina. Funds obtained from the sale of these guides are being utilized in part by the foundation to keep the guides in print and for the publication of additional guides.

Comments and Recommendations

GOAL C is not only desirable and proper, but with the tremendous increase in utilization of South Carolina marine recreational resources, it is an absolute necessity. With today's increasing emphasis on recreation, combined with the ever-increasing price of food, and in particular, seafood, the numbers of individuals gathering their own seafood is increasing at a phenomenal rate. Some natural resources are limited and are already nearly depleted (i.e., most public shellfish grounds) and others are abundant (some finfish species) and need to be promoted for greater utilization.

Additional problems presently confronting the marine recreational fisheries of South Carolina include pollution, habitat destruction and alteration, accessibility to the resources, and allocation of resources among the various users of coastal resources. These problems are compounded by the fact that basic information concerning the number of individuals who utilize these resources, their rate of participation, and their rate of harvest are not known. The Study Committee agrees with GOAL C and offers the following recommendation to "promote fuller development of the marine recreational fisheries."

Recommendation IV-C-1

Objective 1. of GOAL C should be modified to read as follows:

"Continue and expand public information policy on use of recreational resources."

NOTE: In addition to continued support of the recreational fisheries newsletter, SALTWATER CONVERSATION, a series of inexpensive brochures should be developed concerning such subjects as: artificial reefs, public oyster grounds, flounder fishing, baits and rigs, cleaning fish, cooking and cleaning blue crabs, recreational shrimping, etc. Similarly a series of short (15 to 18 minute) color films on similar topics should be produced. There should be a continued and increased effort in promoting the recreational fisheries in State and National magazines, newspapers, and other outside publications as well as in the electronic media (television, radio, etc.). Efforts of this type would be of considerable value to South Carolina's recreational fishermen and to the State's economy by attracting out-of-state tourists.

Recommendation IV-C-2

Objective 6. Should be modified to read as follows:

"Improve recreational fishing opportunities through stock enhancement activities, stocking of coastal impoundments, and development of fishing facilities (launching ramps, piers, trash disposal containers, fish cleaning stations, comfort stations, etc.) for quality fishing at one coastal impoundment, as a demonstration project.

NOTE: Suggested funding sources for such a project include the National Oceanic and Atmospheric Administration Offices of Sea Grant and Coastal Zone Management, and the Land and Water Conservation Funds of the Department of the Interior.

Recommendation IV-C-3

Objective 7, as recommended by the Study Committee, should be added:

"Develop an expanded program of mission-oriented fisheries research on species of recreational importance."

NOTE: Much of the type mission-oriented research can be identified as follows:

a. Obtain and evaluate data on the extent of participation, harvest, and utilization by marine recreational fishermen and on social and economic significance of marine recreational fishing by species, or groups of species, on an annual basis within acceptable levels of accuracy.

b. Obtain biological and population information essential to meaningful conservation and management of migratory oceanic gamefish such as billfishes and sharks.

c. Identify stocks, determine stock sizes, exploitation rates, migratory patterns and other information needed for management of inshore migratory species which sustain significant marine recreational fisheries.

d. Identify habitat areas of importance to marine recreational fishing (i.e., spawning areas, nursery grounds, and concentration and harvest areas); identify pollutants and physical habitat destruction which impact adversely upon fish populations and other biota important to their life histories; and through existing Federal, State, and local laws and administrative procedures, take steps to protect such habitats and populations from such impacts.

e. Determine the relationships between the commercially-important forage species (anchovies, menhaden, alewives, sauries, etc.) and the economically-valuable, sport-caught fishes.

f. Evaluate the utilization of and encourage development and improvement of natural and artificial habitats to increase production and availability of recreationally important marine fisheries resources.

Recommendation IV-C-4

Continued development of artificial reef programs with emphasis on development of inshore and estuarine reefs.

NOTE: A long term commitment to maintain current and future artificial reefs and reef buoys is needed (a long-term, state-appropriated fund established solely for buoy maintenance is needed). A means of increasing the priority level in obtaining United States surplus property needs to be explored and implemented. Existing offshore reefs need to be maintained and additional material added when available. A series of midwater reefs (trolling alleys) should be deployed annually off South Carolina's coast along highly populated areas such as Beaufort,Charleston, Georgetown, and Myrtle Beach. At least two inshore/estuarine reefs should be constructed and then evaluated for success in terms of materials used (concrete rubble, discarded tires, plastic modular units, etc.), for stability, durability, fishing success, and utilization by the fishing community. The development of inshore/estuarine reefs in association with the building of State-owned fishing piers should be evaluated (see recommendation IV-3-C).

Recommendation IV-C-5

Explore means of improving access, including adequate parking areas, to recreational resources by shore-based fishermen through such projects as State developed fishing piers, bridge catwalks, jetty capping, and shore access.

NOTE: A survey identifying and delineating existing saltwater recreational fishing facilities and their access within the coastal zone of South Carolina should be carried out. Cooperative efforts should be made with the South Carolina Coastal Council in providing beach access for surf fishermen. Similarly, efforts should be made with the South Carolina Department of Highways and Public Transportation to provide additional catwalks on the numerous bridges and jetty cappings throughout the coastal area, with suitable adjacent parking areas. State-owned fishing piers, similar to those presently developed by the Washington State Fisheries Department which incorporates the building of surrounding artificial reefs should be studied and evaluated. If found desirable and feasible in South Carolina waters, a pilot program should be developed, including the construction of a test pier built specifically to meet the needs of modern-day South Carolina pier anglers. State-owned and operated fishing piers would be an appropriate State endeavor as coastal land value, construction and insurance costs for a moderate fishing pier far exceed the economic return that a private investor would be willing to accept. State-owned piers should be welcomed by area businesses (restaurants, motels, amusement parks, etc.) as they would realize significant economic benefits. Consideration should be given to include part of the fuel tax for building catwalks and jetty cappings.

Recommendation IV-C-6

Develop an expanded data base relative to harvest, participation rates, effort and socio-economic data on major segments of recreational fisheries.

NOTE: Accurate information, which will provide estimates of the number of State and out-of-State residents who participate in the various segments of South Carolina's saltwater recreational fisheries, to determine the magnitude of fishing pressure by season, and fishing method by geographical area. Also, we need to provide estimates of the

magnitude of the recreational finfish and shellfish harvest for the proper management of South Carolina's marine resources. A State-wide comprehensive survey covering the various segments of these fisheries should be given the highest priority.

Recommendation IV-C-7

Develop an improved management system for public shellfish areas.

NOTE: Many existing State shellfish and public oyster grounds have been depleted. All State shellfish grounds should be surveyed in order to locate and establish additional recreational shellfish areas. Annual funding needs to be obtained to transplant a significant number of oysters from polluted areas, to thin over-populated beds, and to maintain signs marking public grounds.

More efficient management techniques need to be developed. A better working relationship with ongoing research at Clemson University on the development of a mechanical oyster harvester should be explored. Utilization of a mechanical harvester to upgrade and maintain State-owned shellfish beds would greatly increase the harvesting capacity of existing public oyster beds.

Recommendation IV-C-8

Improve recreational fishing opportunities through stock enhancement activities, and stocking and development of fishing facilities at coastal impoundments.

NOTE: A State-wide survey delineating location, access, ownership, present management and utilization (water fowl), salinity, etc., of South Carolina coastal impoundments is required. Research aimed at developing the techniques and feasibility for spawning, raising and stocking of suitable marine species, such as channel bass, under the conditions found in South Carolina impoundments, needs to be conducted. Similarly, the stocking of crustaceans (blue crabs) needs to be explored. A program to encourage the utilization of such techniques by private impoundment owners (fee-fishing ponds, food production, etc.) should be developed.

Recommendation IV-C-9

Maintain an open line of communication between the Recreational Fisheries Program and the saltwater recreational community.

NOTE: Historically there has been a good working relationship and rapport between the saltwater sportfishing community and the South Carolina WMRD. This has developed over the years and results primarily from the high visability of the various recreational fisheries programs. However, with the increasing demands being placed on the recreational fisheries resources of this State, and as the importance of recreation increases, it is becoming more and more important that an open line of communication exists between the WMRD and the public. Sportsmen need to be kept aware of the activities not only of the WMRD, but the State legislature, the South Atlantic Regional Fishery Management Council, and other organizations which affect these fisheries.

A liaison-type position needs to be established within the recreational fisheries program. This person would serve as a direct link or liaison between the WMRD and the sport fishing community. This individual, working closely with the various saltwater sport fishing clubs, would not only provide the services to inform and educate the public to wildlife programs but would serve to bring back ideas, concerns, and recommendations back to the WMRD. Responsibilities of this employee would include assisting in the preparation of SALTWATER CONVERSATIONS, preparation of news releases, preparation of brochures and exhibits, working directly with the various saltwater sport fishing clubs by assisting these associations and others by attending meetings, securing speakers and by helping to set up and promote saltwater sportfishing tournaments.

A Master Angler Awards Program should be established whereby anglers landing a marine gamefish weighing more than an established minimum weight would be presented a certificate and/or possibly a tie tack, patch, or other suitable award. Such a program would provide a great deal of public interest and public relations at a minimal cost.

GOAL D. DEVELOP AQUACULTURE AS A VIABLE COMMERCIAL ENTERPRISE IN SOUTH CAROLINA

Objective 1. Develop the Waddell Center into a recognized research and demonstration unit.

Objective 2. Continue to develop technology on high priority species.

a. Prawns

b. Clams

c. Oysters

d. Red drum

e. Shrimp

f. Scallops

g. Striped bass/hybrids

h. Eels

i. Others as identified.

Objective 3. Examine institutional barriers to successful mariculture and attempt to remove those barriers.

Background

As was stated previously, the DMR of the South Carolina WMRD was created through WMRD reorganization by the South Carolina Wildlife Resources Commission on July 18, 1969. The Commission charged the DMR with the management, development, and proper utilization of the State's coastal resources for present and future generations of South Carolinians. The DMR was organized into the OCMM and MRRI, plus an administrative section.

From the beginning, one of the primary duties assigned to the MRRI was to conduct research leading to the development of mariculture as a viable

enterprise in South Carolina. The first laboratories of the MRRI were completed at the Marine Resources Center in Charleston in 1972, and since that time MRRI staff have been deeply involved in a variety of types of mariculture. At present, six MRRI scientists (Drs. Bishop, Burrell, Liao, Manzi, Sandifer, and Smith) are involved in mariculture activities.

Status

All of the mariculture research and development activities of the MRRI are directed toward removing the major impediments to the practical cultivation of various seafood species. In virtually every case, MRRI scientists are interacting directly with potential users of the information being generated.

Program Activities

1. Freshwater Prawns

This program has focused on the development of a suitable technology for cultivation of the prawn through all its life stages specifically in South Carolina. Through these efforts, many of the major biological problems have been resolved, and preliminary analyses now suggest that small-scale seasonal culture may be commercially feasible in South Carolina. Thus, MRRI scientists have already begun working with some interested private growers and seafood dealers to extend the technology to the private sector and to develop local markets for prawns. These areas are the major subjects of the first project listed below. The possibilities for commercial cultivation of this animal will increase markedly if intensive culture techniques can be developed; or a hybrid prawn, with improved characteristics, produced. These are the subjects of the second and third projects.

Project: Demonstration of Commercial Prawn Farming in South Carolina. Funded by Sea Grant, $45,270.

Project: Intensive cultivation of shrimps and crabs in recirculating seawater systems. Funded by the Coastal Plains Regional Commission, $53,000.

Project: Artificial insemination, in vitro fertilization and hybridization of the freshwater prawn. Funded by Sea Grant, $20,600.

National and international cooperative activities involve MRRI, University of Hawaii, Hebrew University (Israel) and others.

2. Soft Shell Crabs

Individually, soft crabs are worth up to 20 times as much as hard crabs. In other States, such as Virginia, Maryland, and Louisiana, production of soft crabs are an important seafood industry. This is not the case in South Carolina, however. Major limitations are the availability of peeler crabs (crabs just before they shed) and knowledge by local crabbers in how to recognize, capture, handle, and shed peeler crabs. This program is aimed at removing both these impediments and thus helping stimulate the establishment of a small but valuable soft crab industry in the State.

Project: An investigation of the distribution of peeler crabs in estuaries and their catchability for establishment of a soft-shell crab industry in South Carolina. Funded by the Coastal Plains Regional Commission, $56,000.

3. Sturgeon

The sturgeon fishery was once fairly significant in South Carolina, but it has been declining for many years. A major problem apparently has been the loss of spawning areas due to damming practices and deterioration of water quality. Thus, the MRRI has undertaken a long-term research activity concerning the fisheries biology and ecology of South Carolina sturgeon stocks to determine if these stocks could be rehabilitated through a restocking

program. Program biologists have already succeeded in inducing spawning of the Atlantic sturgeon and reared some of the larvae. It is now intended to develop routine hatchery techniques for this species such as those used so successfully for striped bass.

Project: Life history, ecology, and culture of Atlantic sturgeon in South Carolina. Funded by the U.S. Fish and Wildlife Service, $35,000.

4. Striped Bass Hybrids

The culture of salmon in saltwater net cages is a commercial reality in several areas of the world. One private company, DOMSEA Farms, Inc., a subsidiary of Campbell Soups and a pioneer in the development of net-pen culture in the United States, believes that striped bass hybrids also have potential for such culture. This company has joined with our personnel in a cooperative study to determine if striped bass hybrids can be reared profitably in saltwater net cages in South Carolina. The first phase of this work has produced extremely encouraging results, and we are now attempting to identify funding to allow continuation and expansion of the program. If our experiments are successful and the necessary legal changes can be made, it is quite likely that a significant net-pen culture industry could develop in South Carolina.

Project: Net pen culture of striped bass hybrids in South Carolina estuarine waters. Funded by DOMSEA Farms, $32,000.

5. Oysters

At present, more than 95 percent of all South Carolina oysters grow in intertidal clumps. These are difficult to harvest and of relatively low value. Conversely, subtidally grown oysters lend themselves to mechanical harvesting and command a high price. One aspect of this program is directed toward development of commercially viable techniques for culture of single

oysters in South Carolina's estuarine waters and impoundments. A second effort is directed toward perfecting techniques that will lead to higher sustained yield of better quality intertidal oysters. Particular emphasis is placed on developing measures which will enhance and maintain oyster production on public grounds. This latter goal involves work on development of a mechanical oyster harvester in cooperation with Clemson University and other groups.

Project: South Carolina oyster culture study. Funded by the State of South Carolina (additional sources or increased level of funding needed badly).

6. Clams

The South Carolina clam fishery is based primarily on commercial grounds in the Santee River. It is likely, however, that these grounds will be destroyed by low salinity waters accompanying rediversion of the Santee. A possible alternative to loss of this fishery appears to be development of techniques for intensive tray culture of clams in other coastal waters of the State. Biologists of the MRRI are conducting an extensive field investigation of such culture, including a detailed economic analysis. The program has a high probability of success, as indicated by the direct participation of two private clam growing firms (Aquaculture Research Corporation of Massachusetts and Trident Seafarms of South Carolina.

Project: A demonstration scale analysis of hard clam culture in South Carolina. Funded by Sea Grant, $20,000 (participation by ARC, Inc., and Trident Sea Farms; private participation will total approximately $300,000 over a 3-year period).

7. Other Activities

A. National/International

1. Staff are very active in the primary professional organization of mariculturists, the World Mariculture Society.

2. Staff participate in cooperative aquaculture projects with researchers at the University of California, the University of Hawaii, and Hebrew University.
3. Staff participate regularly in national and international aquaculture conferences and planning sessions.
4. Staff provide limited assistance to international organizations such as the Food and Agriculture Organization of the United Nations and the Artemia Reference Center in Belgium for training of foreigners, evaluation of research and production programs, facilities, etc.

B. Legislative

Staff are in the process of collecting and synthesizing available information on laws concerning aquaculture in a variety of States. This report, when completed, will assist us in making recommendations concerning the kinds of aquaculture laws South Carolina should have.

C. Planning

Staff are working to develop a comprehensive mariculture development plan for South Carolina. No specific funds are available for this activity. However, we believe it would be best to secure some moderate level funding and develop this as a true Statewide project involving not only MRRI staff but also personnel from Clemson, the USC, the State Department of Agriculture, the State Development Board, and perhaps local offices of relevant Federal agencies.

D. Facilities Development

Perhaps the single most important activity of the MRRI mariculture program is the design and implementation of a research and development center

for mariculture research. This facility, which is in the master planning phase at present, will be located at Victoria Bluff on the Colleton River near Beaufort, South Carolina, and will be named the James M. Waddell, Jr., Mariculture Research and Development Center. The purpose of this Center will be to provide the pilot-scale pond, tank, and other facilities necessary to translate the results of laboratory studies into commercially viable technologies.

Major Problem Areas

1. Funding

To date, with the exception of a few staff salaries, virtually all mariculture program funds have had to be generated through outside grants and contracts. These sources, of course, specified the ways in which the funds could be spent. Such contract and grant funds provided for nearly all the supplies, equipment, travel, and personnel utilized in mariculture activities.

In 1979 the South Carolina General Assembly authorized three new positions for the mariculture program (two biologists, one of whom will shift to the Waddell Center upon its completion, and a secretary), plus a small amount of equipment and supply money. Yet, even after the addition of these personnel, the mariculture work force remained overwhelmingly dominated by grant-supported staff (see below). In 1980 the General Assembly increased the level of support for the mariculture program authorizing the six new positions which will be needed to operate the Waddell Mariculture Center and providing some funds for equipping the Center. However, since July of 1980 the 7 percent personnel reduction ordered by the Budget and Control Board has forced the loss of all these new positions. Hopefully, the General Assembly will re-authorize these positions (since the Center cannot be operated properly

without them) and will continue developing an appropriate State funding base for the Center. Such personnel and activities funding are essential for the development and operation of the Waddell Mariculture Center. Judging from past performance, it is anticipated that the scientists involved in the mariculture program will continue to do their part in attempting to secure outside funding for a variety of activities, but a stable base level of State support is crucial. This situation is also true for the MRRI as a whole. The

MARICULTURE STAFF SUMMARY

Title	Number	Total Effort (MY)	Percent Grant Funded
Scientists	6	3.6	27.8
Biologists/Tech.	16	14.1	70.9
Secretaries	2	0.8	-0-

Waddell Center is not intended to supplant the mariculture activities at the MRRI in Charleston but rather to augment them. Yet, the MRRI has essentially no direct funding for mariculture activities, except in the form of a few senior personnel. In this connection, a small amount of operational funds for supplies, travel, etc., is desparately needed.

2. Facilities

Perhaps the primary constraint to the development of mariculture in general in the United States and specifically in South Carolina has been the lack of suitably scaled research facilities. While much valuable research can only be done in laboratories, in many cases, it is impossible to apply laboratory results directly to commercial production systems. What is needed to bridge the gap between the laboratory and the commerical mariculture farm is a "Mariculture Research and Development Center" which would provide numbers of saltwater ponds, fish and shellfish pen facilities, large tanks, hatchery

facilities, etc., necessary to develop, refine, and demonstrate mariculture technology under more or less "real world" conditions. Such a facility is currently being planned for Victoria Bluff on the Colleton River near Beaufort, South Carolina, with construction on the first phase scheduled to begin in 1981. What is needed now is continuing commitment from the State Legislature to provide the capital funding to complete the necessary facilities and the continuing base of personnel, equipment, supply, and travel funds to maintain its operations.

3. Interinstitutional Cooperation

The MRRI staff has been involved in cooperative mariculture research with Clemson University staff and personnel of the Charleston Laboratory of the NMFS to a fairly large extent and to a lesser degree with staff of the USC and the Medical University. Such interinstitutional cooperative ties should be strengthened to bring as much expertise to bear on mariculture R&D problems as possible.

4. Legal Impediments

Legal and institutional barriers appear to be a major impediments to the development of certain types of commercial aquaculture. A detailed study of such barriers needs to be undertaken in South Carolina and legislation to promote aquaculture development prepared.

5. Education

There is a broad lack of information on aquaculture among the general public, and there is a specific lack of educational training in aquaculture at both the technical and higher education levels. This gap needs to be filled if South Carolina is to become a leader in the field of aquaculture.

Comments and Recommendations

Recommendation IV-D-1

The list of objectives should be revised and expanded as follows:

Objective 1. Develop the Waddell Mariculture Center into a regionally, nationally, and internationally recognized research and demonstration unit.

Objective 2. Promote the development of aquaculture businesses in South Carolina and, where mutually advantageous, participate in cooperative research, development, and demonstration projects with the private sector.

Objective 3. Attract increased aquaculture-related funding and conferences to South Carolina and increase aquaculture informational and educational services for South Carolinians.

Objective 4. Continue and expand efforts to develop practical culture technology for high priority species such as prawns, clams, oysters, red drum, shrimp, scallops, striped bass hybrids, sturgeon, eels, and others.

Objective 5. Evaluate the aquaculture potential of existing marsh impoundments and determine the comparative productivity of impounded and natural marshlands.

Objective 6. Develop and demonstrate technology for use of waste products and unconventional energy sources (e.g., solar energy, thermal effluents, geothermal waters) for aquaculture.

Objective 7. Evaluate the potential for augmenting selected marine recreational and commercial fisheries through stock enhancement trials associated with artificial reefs, coastal impoundments, etc.

Objective 8. Work with the OCMM and the State Development Board to promote aquacultured products and develop sound markets for them.

Objective 9. Promote interinstitutional cooperation in the development of aquaculture and related activities in South Carolina.

Objective 10. Examine institutional barriers to successful aquaculture enterprises and attempt to remove these barriers.

Objective 11. Investigate the potential and environmental impacts of aquaculture and seafood processing enterprises in coastal South Carolina.

Objective 12. Conduct socio-economic studies to determine feasibility of selected aquaculture activities and to identify means of mitigating potential water- and land-use conflicts.

Recommendation IV-D-2

The State should provide a firm base of funding for personnel and operating expenses for the mariculture program. Such funds are absolutely essential for the Waddell Mariculture Center and the entire mariculture program. In particular, the six personnel positions (3 biologists, 2 maintenance people, 1 secretary) must be authorized if the Center is to become functional. It simply cannot work without a resident staff. Including salaries, a State operating budget on the order of $500,000 per year is recommended for the present.

Recommendation IV-D-3

Plans should be developed to improve interinstitutional cooperation in mariculture research. Planning for programs at the Waddell Mariculture Center should include consideration of ways to involve faculty, staff, and graduate students from various interested institutions in the research and development programs of the Center. An interinstitutional team led by MRRI staff should be established to prepare an aquaculture development plan for South Carolina.

Recomendation IV-D-4

MRRI staff should provide assistance to the legislature and other agencies in determining legal changes needed to foster aquaculture development in South Carolina and to minimize possibilities of water- and land-use conflicts.

Recommendation IV-D-5

The mariculture program staff, working in collaboration with the South Carolina Sea Grant Consortium and the CHEC, should develop a plan to (1) increase public awareness of aquaculture, (2) provide technical training as needed in aquaculture and fishery skills, and (3) provide graduate research and education opportunities in aquaculture.

GOAL E. INCREASE UNDERSTANDING OF THE COASTAL AND MARINE ENVIRONMENT

Objective 1. Continue studies on effects of dredging and dredgespoil disposal.

Objective 2. Conduct special studies at request of State Coastal Zone Management Agency.

Objective 3. Continue studies on ecology of barrier islands.

Objective 4. Continue studies of potential energy-related impacts.

Objective 5. Continue to work internally and cooperatively with State and Federal agencies on beach erosion problems and solutions.

Objective 6. Continue program of evaluation permits for coastal alterations.

Background

In July of 1969, the DMR of the South Carolina WMRD was established through internal reorganization, under authorization of State law. In addition to an administrative office, two functional units were created within the Division, the OCMM, and the MRRI. One of the primary duties of the OCMM was "to conduct investigations of coastal resources to provide recommendations for use and protection of these resources." Among the duties spelled out for the MRRI were the following: "Conduct environmental studies in estuarine and coastal waters," and "Study physical processes such as erosion, siltation, and sedimentation that affect the living and non-living marine resources of South Carolina." (Prior to the above-noted reorganization, the DMR's predecessor, the Division of Commercial Fisheries, had for many years been involved in the evaluation of permit applications for coastal construction projects through

the U.S. Army Corps of Engineers and the State of South Carolina; and in the investigation of fish kills, and other related environmental matters).

Under South Carolina law, the DMR (and the WMRD) has jurisdiction over: all salt-water fish, fishing, and fisheries in the State's coastal zone (S. 50-520); and the protection of non-game and endangered species in the coastal zone (Chapter 15, Title 50). Since living marine and estuarine resources are dependent upon a healthy environment, it is imperative that the DMR be actively involved in environmental and ecological matters, especially those which have impact upon fisheries.

In addition to the aforementioned responsibilities, the Fish and Wildlife Coordination Act provides that the South Carolina WMRD shall be consulted concerning any proposed coastal alteration in the State by any Federal agency or by any public or private agency under Federal permit or license. This authorizes input by the WMRD into (1) the Federal permitting system and (2) construction projects by Federal agencies, such as the U.S. Army Corps of Engineers.

The South Carolina Coastal Zone Management Act of 1977 provides for a Coastal Council. It also provides for input by the WMRD in environmental matters under Council jurisdiction and for WMRD support and assistance where necessary. Approval of State permits for coastal alteration through the Council is conditioned upon the extent to which the applicant's completed project will affect the "production of fish, shrimp, oysters, crabs, clams, or any marine life..."

The legal authorization and justification for the DMR's involvement in coastal environmental matters, therefore, seems quite clear.

Status

The DMR is currently involved in a number of programs and projects related to the increased understanding and protection of the coastal environment.

Within the OCMM there is an Environmental Evaluations Section which has the following duties and responsibilities.

1. The review and evaluation of all proposals and permit applications for coastal alterations and related environmental impact statements through the South Carolina Coastal Council, U.S. Army Corps of Engineers, U.S. Coast Guard, and South Carolina Department of Health and Environmental Control. Emphasis is placed on impact to fisheries habitat. Comments are forwarded to the Executive Director of the South Carolina WMRD for inclusion in a final statement to the appropriate permitting agency.

2. The investigation and evaluation of fish kills and oil or chemical spills in the coastal area, in cooperation with the South Carolina Department of Health and Environmental Control and the U.S. Coast Guard.

3. Survey and mapping projects, including a recently completed inventory of coastal wetlands in South Carolina and a detailed delineation of wetlands habitats in the coastal zone under contract with the U.S. Fish and Wildlife Service, National Wetland Inventory. Currently, a detailed inventory of the Santee and Cooper River Systems, under contract with the U.S. Fish and Wildlife Service, is underway.

4. Maintaining a library of charts, aerial photographs, and other graphic information concerning coastal wetlands for use by the DMR, other interested agencies, and individuals.

5. Providing support to the commercial shellfish section for maintaining current status of shellfish lease maps, condition and extent of all State shellfish bottoms.

The MRRI has a number of ongoing studies related to marine and estuarine ecology. These include:

1. Estuarine survey projects to assess the basic biological, chemical, and physical characteristics of major South Carolina estuaries. Recently, studies have been completed in the

Winyah Bay and Santee areas, and data has been made available for use in environmental impact statements, etc.

2. Spatial and temporal distributional patterns of fishes and decapod crustaceans in South Carolina estuaries.

3. Dredging and dredged material disposal research, including studies of benthic ecology in open ocean disposal areas and the effects of overboard disposal in shallow estuarine waters. Recent projects in the vicinity of Sewee Bay and Charleston Harbor have been completed.

4. Ecological investigations of the effects of rubble weir jetty construction at Murrells Inlet and Little River, South Carolina.

5. Investigations of the ecological effects of rediversion on the Santee and Cooper River system.

6. Coastal and offshore oil and gas investigations, including studies for pipeline corridors in the coastal zone, and studies of offshore live bottoms to provide information on the renewable resources in these areas.

7. Coastal geology and beach erosion investigations aimed at describing sediment transport, sand budgets, etc. One major objective of this work is to provide information useful in implementing beach erosion abatement and in planning future coastal developments.

Comments and Recommendations

The Study Committee considers GOAL E to be a valid and desirable one for the DMR in the 1980's. This goal is in line with the duties and responsibilities of the DMR as provided under State and Federal legislation and as envisioned by the 1968 Committee of Consultants in their report to the South Carolina Wildlife and Marine Resources Commission.

The continuation and expansion of the programs and projects being carried out under the various objectives of this goal will provide ecological and other information needed by the DMR in its fisheries management responsibilities, and by the South Carolina Coastal Council and other agencies

involved in the coastal zone management process. In addition, investigations concerning potential energy-related impacts on the marine environment, ecological studies of estuaries and barrier islands, development of mitigation techniques, and research on coastal beach erosion which will provide useful information for developers and private industry in planning future operations along the South Carolina coast.

In connection with Goal E, the Study Committee offers the following recommendations:

Recommendation IV-E-1

Objectives for GOAL E should be rewritten as follows:

Objective 1. Continue ecological studies aimed at increased understanding of the coastal and marine environment, including: investigation of the effects of dredging and spoil disposal; special studies requested by coastal zone management agencies; and studies of potential energy related impacts on the coastal area.

Objective 2. Continue and expand research and monitoring activities concerning the physical and chemical aspect of coastal estuaries, placing emphasis on water quality studies and hydrologic investigations into problems associated with wetlands alterations (marine construction, canals, etc.).

Objective 3. Continue the environmental monitoring and assessment program, including: the evaluation of State and Federal permits for coastal alteration proposals; cooperative investigation of fish kills and oil spills; and wetland resource inventory projects.

Recommendation IV-E-2

Consideration should be given to a detailed inventory of coastal impoundments, along with comprehensive ecological studies of these areas. Consideration should be given to specific ecological studies designed to provide needed information relative to fisheries resources associated with abandoned rice fields in tidal brackish and freshwater as well as habitat utilization and life history studies of selected species. Emphasis should be placed on anadromous

and oligohaline species within these environments and resultant impacts due to construction of impoundments. Cooperation with the CHEC and the South Carolina Sea Grant Consortium should be requested.

Recommendation IV-E-3

Detailed environmental evaluations of the effects of mechanical shellfish harvesting should be conducted by the MRRI, as a part of Objective 1. This should include both subtidal harvesters and the newly developed intertidal oyster harvesters.

Recommendation IV-E-4

Increased emphasis, in cooperation with the South Carolina Department of Health and Environmental Control, should be placed on studies pertaining to the occurrence, toxicity, and environmental effects of pesticides, heavy metals, treated storm water runoff, and other pollutants in the estuarine and coastal environment.

Recommendation IV-E-5

Under Objective 1, emphasis should be placed upon continued investigations of ecological effects of the Santee-Cooper rediversion project.

Recommendation IV-E-6

The legislative mandates of the DMR and that of the Department of Health and Environmental Control, with respect to environmental monitoring of coastal waters, shellfish management activities, and fish kill investigations should be re-evaluated by the South Carolina General Assembly and appropriate changes made accordingly. Currently, there is considerable overlap and fragmentation of effort in these areas. Consideration could be given to strengthening existing the South Carolina WMRD legislation (Article 9) to authorize the investigation of fish kills and analyses of samples for pesticides and other pollutants, and provide increased penalties for violations. Existing laws could also be amended to provide that all enforcement and monitoring of shellfish growing areas be under the WMRD.

Recommendation IV-E-7

The concept of mitigation (loss prevention compensation, replacement, enhancement) as a tool for abatement of wetland habitat loss should be researched. Issues to be addressed

should include: evaluative criteria, mitigation alternatives, mitigation methods and implementations, relative values, follow-up evaluations, and early planning mitigation.

Recommendation IV-E-8

Forested wetlands subject to the U.S. Corps of Engineers' jurisdiction under Section 404 of the Clean Water Act (33 U.S.C. 1344) should be identified as a management unit requiring special consideration. Studies designed to determine fisheries resource value, especially value to anadromous fishes, and potentially critical habitat, should be undertaken. Impacts to fisheries habitat resulting from irrigation canals, spoil disposal, and silvicultural operations should be studied.

Recommendation IV-E-9

Research into varied hydrological problems associated with wetland alterations and development in the coastal plain should be implemented by MRRI or through the appropriate research consortium. Information and guidance relating to the design of drainage systems, marinas and navigational canals, lagoon systems, irrigation ditches, and other pertubations is needed ro provide realistic recommendations for environmental acceptable decisions.

GOAL F. PROVIDE LOGISTIC AND STAFF SUPPORT TO STATE COLLEGES AND UNIVERSITIES

Objective 1. Provide space in cooperative research facility.

Objective 2. Provide vessel support for research and training programs of colleges and universities.

Objective 3. Contribute to development of the Charleston Higher Education Consortium (CHEC) graduate program in marine science.

Background

When submitting its final report to the South Carolina Wildlife Resources Commission in 1968 on its findings regarding a long-range program for management and development of the State's marine resources, the Committee of Consultants stressed the need for additional capabilities in marine resources research, management and development. After careful evaluation of the State's needs, the Committee unanimously concluded that "...the primary functions which a state-supported marine science program must perform are: (a) mission-oriented research..., and (b) services to management and planning agencies. Other functions such as education of graduate marine scientists are secondary at this point. Some capabilities in education already exist. This is not to say that South Carolina's recommended State-supported 'Institute of Marine Sciences' should not be involved in education or fundamental research, because it should, but only that mission-oriented research and service are the primary needs."

According to a 1967 proposal prepared by Clemson University, South Carolina had, at that time, "...no state-supported academic facilities for teaching and research in Marine Biology." It is true, however, that Clemson University and the USC were developing long-range plans for granting the M.S.

degree, and possibly the Ph.D. degree, in marine biology. Both universities had capabilities (courses, staffs, library facilities, equipment, etc.) which could support the proposed programs. The College of Charleston had a year-round undergraduate program in marine biology, including course work in ichthyology, and research was being conducted at the College of Charleston's Grice Marine Laboratory, Fort Johnson. The Citadel and the Medical College of South Carolina also had capabilities for providing important support for a State marine laboratory. The Committee of Consultants stated that South Carolina was most fortunate to have Bears Bluff Laboratories, located on Wadmalaw Island, available for State research work and services during the preceding 22 - 1/2 years, but that State work at the Laboratories had been of a limited nature mainly because funds, averaging about $45,000/year, were small (and salary structure inadequate). The Committee reported also that (1) the stated purpose of the Laboratories was "to offer facilities for study and, through education and research, to develop the marine resources of South Carolina," and (2) that the Laboratories were internationally known for their saltwater pond culture work. All of the aforementioned institutions and laboratories indicated that they were interested in cooperating in supporting a State marine science laboratory and programs.

Regarding the need for a State marine science laboratory and coordination with institutions of higher learning, the Committee of Consultants concluded:

> "It is clear that despite the marine research and training facilities presently available at Bears Bluff and Fort Johnson, additional laboratory space and equipment, including suitable vessels for inshore and offshore work, are necessary. These, along with the skilled

> personnel needed, are difficult to acquire and costly to maintain. Hence, it is important that they be designed and operated so as to be of use to the institutions of higher learning desiring or requiring access to such facilities and to the marine environment. Though it is essential that the marine science program that we envision be autonomous, arrangements should be made for affiliation of the professional personnel with one or more academic institutions. This liaison between government research establishments and universities, though not without problems, has proven to be most productive elsewhere and it is wise use of costly and scarce scientific resources... By such arrangement not only are the facilities and personnel of the research establishment available for teaching and to the research programs of the universities, but recruiting is made easier for both entities and constant contact is maintained. Further, interfertilization and stimulation is facilitated. Students present challenges to full-time researchers, encouraging them to remain abreast. Students benefit from association with a research facility with capability, mission and problems. Most scientists prefer not to be too-far removed from the academic environment and its activities."

Status (see pages)

As pointed out previously, one of the duties assigned to the MRRI even before its actual existence was to provide physical facilities in support of marine science curricula of the State's colleges and universities and to cooperate with them in any way deemed appropriate. Today, several of the scientific staff hold adjunct appointments at various colleges and universities within the State and occasionally participate in both teaching and direction of graduate research. College and university audiences have been provided opportunities for training and research cruises aboard DMR vessels, and MRRI staff have participated in a variety of cooperative research programs with college and university faculty. The most recent addition to the MRRI's

physical facilities, the 32,000 square foot Cooperative Research Facility, was developed under an agreement between the Wildlife and Marine Resources Commission and the South Carolina Commission on Higher Education not only for the expansion of the MRRI but also to provide certain shoreside facilities in support of the academic marine science programs in the State's colleges and universities. In fact, nearly a third of this building is set aside for use by the various State colleges and universities for marine science activities.

Clemson University offers marine science programs in the College of Agricultural Sciences, the College of Sciences, and The Belle W. Baruch Forest Science Institute which is administered by the College of Forest and Recreation Resources. The Belle W. Baruch Forest Science Institute of Clemson University sponsors research and education programs in areas related to marine science. Current research involves dune stabilization, spoils bank reclamation, flora and fauna of rice fields, fresh-water marshes, and management of maritime forests for optimum aesthetic and productive values. The Institute manages 7,500 acres encompassing all of the habitats mentioned above. In addition to the facilities of the Belle W. Baruch Forest Science Institute at Georgetown, South Carolina, Clemson University utilizes facilities at Morehead City, North Carolina, and Charleston, South Carolina, through cooperation with other institutions. On the main campus, lecture and laboratory space in the areas of geology, zoology, microbiology, and biochemistry are available for teaching and research in marine science.

The USC offers both M.S. and Ph.D. degrees in marine science. The program in marine science provides an interdisciplinary approach to the study of estuarine and coastal waters and includes several projects in deep ocean waters. Students may choose to specialize in biological, chemical, geological

or physical oceanography; the largest number of theses and dissertations have been completed in the areas of marine biology and coastal geology. Chemical, geological and physical oceanography are currently expanding. Within the curriculum other concentrations, such as environmental modeling, oceanographic data processing, coastal engineering and marine affairs, can be developed. Each graduate program is specifically tailored to the individual's interest and career objectives.

The Belle W. Baruch Institute for Marine Biology and Coastal Research provides the research focus for marine science projects at the USC and enables the Marine Science Program to accommodate the research goals of individual students. The research facilities of the Marine Science Program are located both at the USC's main campus in Columbia and at Hobcaw Barony just north of Georgetown, South Carolina. A modern field laboratory, conference center, living quarters, environmental chambers, saltwater holding systems, monitoring, sampling, and collecting gear; boats, and a launching ramp are available for the conduct of coastal marine research. Hobcaw Barony is composed of 17,500 acres bordering Winyah Bay and the Atlantic Ocean, and includes 7,500 acres of pristine salwater marsh, ocean beaches and dunes, a high-energy tidal inlet, marine bird rookeries, oyster banks, clam beds, many miles of tidal creeks, and a complete ecological progression from the ocean to coastal highland environments. On the main campus, the research and educational resources of the entire USC are accessible to marine science graduate students, depending on individual study and research needs, and include office and laboratory space, seawater aquarium systems, environmental chambers, respirometers, transmission and scanning electron microscopes, low-level radioisotope and stable isotope laboratories, gas and liquid

chromatographs, seismographs, and a wave tank, as well as conventional equipment. Students also have access to Cooper Library, with its excellent marine science collection, and the USC's multiple-access computer center.

At the recommendation of the South Carolina Commission on Higher Education, the Charleston Higher Education Consortium (CHEC) was created in 1969 by the same legislative statute that changed The College of Charleston from a private to a state-supported institution and that changed the name of the Medical College of South Carolina to the Medical University of South Carolina. The creation of the CHEC and the changing of the status of The College of Charleston and the Medical College each contributed to a larger purpose: the establishment of a coherent, coordinated "system" of higher education for the citizens of the Lowcountry and the citizens of the State. By 1976 the CHEC had developed to the point where, in order to capitalize on its accomplishments and to venture into new areas of cooperation, its separate incorporation became necessary. Accordingly, a Steering Committee drafted a written statement of the principles and objectives of cooperation in the late Spring of 1976 and drew up formal Articles of Organization in the Fall. The "principal purpose" of the CHEC, the Articles state, "shall be to encourage and facilitate cooperation among the member institutions to strengthen and develop interinstitutional programs that cannot be undertaken or accomplished by an individual institution or that can be done more economically and/or effectively through cooperative efforts." In January 1977 the CHEC became legally incoroporated as a non-profit corporation, its membership consisting of: i.e., the Baptist College at Charleston, the Citadel Military College of South Carolina, The College of Charleston, the DMR of the South Carolina WMRD, the Medical University of South Carolina and Trident Technical College.

There are currently three CHEC master's degree program. The Special Education Program, which accepted its first students in 1977, is a joint program offered by The Citadel and The College of Charleston. The Urban Public Administration Program, which accepted its first students in 1978, is jointly offered by the CHEC and the USC's Department of Government and International Studies and is housed in The College of Charleston's Center for Metropolitan Affairs and Public Policy. The Marine Biology Program, has been operating for 6 years.

Created by State legislation in 1978, the South Carolina Sea Grant Consortium was formed to bring together the diverse and extensive talents and expertise of the various State institutions involved in marine research, education, and advisory services. The Consortium is a full state agency, empowered under the Legislative Act Number 643 of 1978. The constituent institutions of the Consortium are: Clemson University, the College of Charleston, the USC, the Medical University of South Carolina, South Carolina State College, The Citadel; and the South Carolina WMRD. The Sea Grant Consortium consists of the Director and The Board of Trustees, who are the Presidents of the Consortium's six academic institutions, and the Director of the WMRD. The formation of the South Carolina Sea Grant Consortium followed several years of informal interaction among the various State institutions. Recognizing the needs and opportunities embodied by the State's unique ocean and coastal resources, these institutions have now formally come together in a formalized effort to develop both long- and short-term projects in research, advisory services, and education. In January 1980, the South Carolina Sea Grant Consortium became an operating entity.

Comments and Recommendations

GOAL F is a desirable and proper goal for the 1980's. This goal is a further extension of what the 1968 Committee of Consultants had in mind when it stressed the need for close coordination between the State marine science programs and the higher education institutions. The Committee of Consultants specifically urged that State facilities (laboratories, boats, equipment, etc.) "be designed and operated so as to be of use to the institutions of higher learning desiring or requiring access to such facilities and to the marine environment." The creation of the CHEC and the South Carolina Sea Grant Consortium, with their principles and objectives toward cooperation, are major initial steps in coordinating State marine science programs with those of institutions of higher learning.

Recommendation IV-F-1

GOAL F should be expanded to read as follows:

PROVIDE LOGISTIC AND STAFF SUPPORT TO STATE COLLEGES AND UNIVERSITIES AND OTHER INSTITUTIONS OF HIGHER LEARNING.

> NOTE: Although directed primarily at providing 'support' to State colleges and universities, it should include, when possible, support to non-State colleges and universities. In some cases, this could be on a reimbursable basis.

Recommendation IV-F-2

Since State laboratory and vessel space is limited and costly, the State WMRD should develop a written and well-publicized policy regarding space allotment.

> NOTE: Under only the most unusual circumstances should valuable space be reserved or set aside and not used.

Recommendation IV-F-3

In the spirit of cooperation with South Carolina institutions of higher learning, the State WMRD should re-evaluate the Governor's Intern Program.

> NOTE: The Study Committee was advised by Dr. John M. Dean, Director of the USC Marine Science Program, that this is a desirable program and a good way to improve cooperation between the USC and the State WMRD, but that for the Program to succeed it would require selection of the student recipients to be made and announced in March of each year rather than in May.

Recommendation IV-F-4

Add the following statement as Objective 4 under GOAL F:

"Objective 4. As a member of the South Carolina Sea Grant Consortium, continue to contribute to the development of a viable South Carolina research, education, training and advisory service program in fields related to ocean and coastal resources."

GOAL G. EDUCATE CONSTITUENCIES AND GENERAL PUBLIC ON MARINE RESOURCES

Objective 1. Production of special publications for special interest groups.

Objective 2. Continue development of workshops on variety of marine resource topics.

Objective 3. Continue to work with public schools on marine affairs education.

Objective 4. Continue to provide speakers for clubs and associations.

Objective 5. Develop public education monies in cooperation with Information and Public Affairs (IPA) Division.

Background

In its review of the DMR and its programs for the decade of the seventies, the Study Committee identified communications and coordination of programs with others as areas that could be improved. The Study Committee noted that these were not problems unique to the DMR but that most agencies and organizations need to strive continuously to improve these program areas.

Status

It appeared to the Study Committee that both the WMRD and the DMR have taken steps in recent years to improve communications and coordination of programs and activities.

The major steps taken can be summarized as follows:

1. Became a member of the Charleston Higher Education Consortium - 1977.

2. Became a member of the South Carolina Sea Grant Consortium - 1980.

3. Assigned a senior staff member of the DMR to conduct direct liaison with the commercial fishing, industry - 1980.

4. Supported the Governor's Executive Order No. 80-34 which requires, among other things, members of the Marine Resources Advisory Board to attend a minimum of 50 percent of the formally scheduled meetings or be replaced.

5. Assigned members of the WMRD Information and Public Affairs Office, Columbia, to Charleston, South Carolina.

Recommendations (See Recommendation III-B)

Recommendation IV-G-1

GOAL G should be modified as follows:

"IMPROVE COMMUNICATIONS AND PROGRAM COORDINATION WITH CONSTITUENCIES AND THE GENERAL PUBLIC ON MARINE RESOURCES MATTERS"

Recommendation IV-G-2

The following objective should be added to GOAL G:

"Objective 6. Continue to particiate effectively as a member of the CCHE and as a member of the South Carolina Sea Grant Consortium."

Recommendation IV-G-3

a. The IPA office of Marine Resources problems. This can be accomplished through coordination and direction. Personnel in the IPA office and DMR should have a basic understanding of who's responsibilities and duties are in the area of information, education, and public relations and build a working relationship through communication and coordination.

b. Technical and scientific information should be presented in a readable form for the general public.

c. Getting information out in a timely manner (news releases) to Conservation Officers and other department personnel simultaneously with the news media.

d. There is a need for a Marine Resource newspaper to keep the marine constituents adequately informed of how marine research and management may be benefiting them.

e. Switchboard - channeling calls, including news media calls, to IPA office for information (see APPENDIX _____).

Imperative that calls from public and news media be handled in the most expeditious manner possible. While there are many people on staff who could possibly handle calls, the IPA office should have the opportunity to satisfy these callers without any undue delay and in a professional manner.

f. IPA personnel and DMR personnel have a monthly meeting to discuss problems, areas of improvements in public relations, etc., to build a better working relationship and improve communications among personnel.

IPA can coordinate better communications between management and enforcement which will lead to a better understanding, thus intelligent cooperation regarding programs, objectives, procedures and activities. This will help solidify a better coordinated management and enforcement effort.

g. Copies of publications should be exchanged with each division in order to keep staff informed of projects and information.

h. There should be meetings between other divisions, not only scheduled meetings but social meetings as well to exchange ideas and information.

Recommendation IV-G-4

Coordination between IPA office and DMR personnel dealing with the news media and general public.

a. IPA office should channel the new media to the correct DMR personnel for statements and information.

b. DMR personnel should contact IPA office before and after (followup) contact with news media.

Recommendation IV-G-5

News Releases

a. Emphasis needs to be placed on the media. Example: The need to get to the proper person for the proper information requested.

b. Followup on a weekly basis to make sure news people are getting the information.

c. The IPA section have to make their contacts with the news media and have the news media calling them instead of the DMR personnel.

d. Personnel in the DMR and Columbia IPA office should go through IPA section concerning information or news events.

Recommendation IV-G-6

Speakers Bureau

a. Develop and coordinate an extensive and aggressive Speakers Bureau to spread the Marine Center message across the State.

b. Coordination between IPA and DMR personnel is of the utmost importance.

c. An important public relations aspect of the Marine Center, namely "one on one" communication with the public.

Recommendation IV-G-7

Magazine

a. Magazine staff should work through Charleston IPA office for ideas and articles in future magazines.

b. In future planning of magazine articles there should be planned articles concerning the DMR.

c. DMR personnel should keep IPA in Charleston informed of ideas or information that could be used as a magazine article or as news in the "Roundtable".

d. Magazine staff should check with the appropriate DMR personnel to make sure information in articles is correct before printing.

Recommendation IV-G-8

Department Newspaper: The Resource

a. Editor of The Resource should follow same as stated in Recommendation IV-G-7.

b. Every issue of The Resource should have stories or information concerning the Marine Center.

Recommendation IV-G-9

(See APPENDIX)

Recommendation IV-G-10

Special Publications

a. Cooperation between DMR and IPA through better coordination and communications.

b. There is duplication of effort and overlap of WMRD personnel responsibilities and duties now. What is needed is a Graphics Arts Printing Specialist in order

to coordinate layout of publications and print quality control and to write printing specifications so the WMRD gets its money's worth.

c. Exchange of publications (1 to 2 copies).

Recommendation IV-G-11

The is need for a full-time photographer-photolab technician within the Charleston IPA Office.

NOTE: The large and varied staff of the DMR requires a great deal of photographic support. Much of this work currently is contracted to commercial operations at considerable cost to the WMRD. In addition, some staff members attempt their own photography and in some cases an amateur photographer who is employed as a biological technician is pulled off his job to do darkroom work. A full time photographer-photolab technician could save the DMR a great deal of money and could provide valuable, progressional photographic support. The present Charleston IPA office staff now supplies many of the above services but on a very limited basis due to additional responsibilities. A full-time photographer-technician could produce high quality photo support without unnecessary delays.

Recommendation IV-G-12

There is need for an Education Specialist within the Charleston IPA Office.

NOTE: An important public relations aspect of the Marine Resources Center, namely direct "one on one" communication with the public, can never by fully utilized without a full-time Education Specialist for this purpose. Each year the Charleston IPA office receives hundreds of requests from groups who wish to tour the Marine Resources Center. Many of these requests cannot be fulfilled by the present office staff. Because so little time is available to devote to tours, a single, standard tour is given to all groups with little regard to the special interests each group might have. A full-time Education Specialist could handle a larger volume of tours and could develop different types of tours for different groups.

The Marine Center complex is a large and impressive facility. visitors are always amazed at the size of the Center and the scope of its activities. Rarely does a visitor leave without a very favorable impression of the WMRD and the work being done. As a result, every effort should be made to encourage groups to visit the Center and to ensure that visitors get the best possible impression of Center activities. This can be best accomplished by a full-time education specialist stationed at the Charleston IPA office.

GOAL H. MANAGEMENT OF COASTAL PROPERTIES OWNED OR OPERATED BY THE DEPARTMENT

Objective 1. Capers Island

Objective 2. Others as may be required.

Background

Capers Island was purchased in February 1975 by the State of South Carolina with fund assistance provided by the U.S. Bureau of Outdoor Recreation. The property was selected as a Heritage Preserve and dedicated as a Heritage Trust Property subject to provisions signed into an Agreement between the South Carolina WMRD and the U.S. Bureau of Outdoor Recreation in 1978.

In recent years, many similar barrier islands along the South Atlantic coast have been developed as private residential resort communities. This trend has approached a critical stage along the South Carolina coast. The acquisition of Capers Island is a significant addition to lands held in public trust and serves an important role in marine research, management and education. This Island will also serve as an important buffer zone between the highly sensitive Cape Romain National Wildlife Refuge and the private residential-resort development of Dewees Island and the Isle of Palms.

Capers Island is a classical barrier island located in Charleston County about 3 miles out from the mainland. It is part of an extensive zone of barrier islands, coastal salt marshes and estuaries that typify the South Carolina and Georgia coasts. The island is 1.4 miles in width, and 3.3 miles in length on the ocean side, and contains approximately 850 acres of highland, 214 acres of front beach, 1,090 acres of unmodified salt marsh, 50 acres of tidal creeks and 110 acres of fresh and brackish water impoundments. In

addition, there are many acres of natural freshwater ponds and low-lying swampy areas on the island.

The maritime forest, impoundments, and marshes of Capers Island provide valuable wildlife habitat for a variety of species such as white-tailed deer, raccoons, alligators, loggerhead sea turtles, and numerous birds. Among the most common birds are herons, egrets, ibises, bitterns, wood ducks, black ducks, blue-winged teal, green-winged teal, shovellers, mergansers, scaup, red-shouldered hawks, red-tailed hawks, woodcocks, coots, brown pelicans, vultures, pileated woodpeckers, and many small song birds. At present, ospreys are nesting on the front beach at the north end of the Island. In addition to the above wildlife, populations of feral hogs, goats, and sheep exist on the Island.

The estuarine zone adjacent to Capers Island contains numerous intertidal oyster reefs along the shores of tidal creeks and on the mud flats in the area. Subtidal bottoms in the area range from soft, highly organic mud, sand, shell and mud mixtures in the creeks to hard sand near the inlet mouths. In many areas "live" bottom communities are present.

The diverse habitat of this area is not typical of the major portion of South Carolina's estuarine area, which is characterized by freshwater drainage and brackish water conditions. The unique nature of the high-salinity estuaries in this area provide a most important nursery area for many important marine and estuarine species, especially brown shrimp, black sea bass, sciaenid fishes and stone crabs.

Status

Currently, the DMR is involved in a number of activities centered around the management of Capers Island. A great deal of time has been devoted to establishing permanent headquarters for a biological technician and visiting

scientists. Recently, a number of cooperative research studies have been carried out on the island. These include the following: (1) marine and barrier island botanical studies; (2) carrying capacity studies; (3) herpetological studies; (4) effects of human disturbance on the reproductive success of least terns and, (5) saltwater impoundment work (mostly maintenance).

Primary management activities involve controlling public use of the island. This is accomplished through the issuance of permits for camping. Although not intended to serve in the same capacity as a State Park, Capers Island has become a very popular location for wilderness camping--similar to the use of wildlife management areas.

Another noteworthy use of Capers Island has been the DMR's Youth Conservation Corps Program. This island has served as the primary work site for the YCC camp during the past three summers. It has provided a great opportunity for high school students to participate in a work-learning program in the marine environment and has served as a tool for teaching marine conservation.

At the present time, work is being done on the maintenance of the impoundment dikes and water control structures which are vital to impoundment studies. Also, improved docking facilities for research vessels and public use are being planned.

Comments and Recommendations

GOAL H appears to be appropriate to the mission of the DMR. It provides a convenient location and suitable environment for scientific endeavors as well as public use. The following recommendations should be considered:

Recommendation IV-H-1

Modify the stated goal to read "Research, Management, and Public Use Activities on Capers Island." This island is a marine resource and should be considered as such in future planning efforts.

Recommendation IV-H-2

As a matter of high priority, it is recommended that an ecological inventory be conducted on Capers Island. Such an inventory will be essential in conservation and management and in providing baseline information for future planning processes. Inventory data can be applied in the examination of certain resources in order to determine the effects of different levels and types of use on the attributes of those resources.

Recommendation IV-H-3

Bounded on the northeast by the Cape Romain National Wildlife Refuge and on the southwest by Dewees Island, the Capers Island area has the potential for becoming an important and much needed public coastal recreational fishing area. With the increasing private development of coastal islands to the south of the Charleston Metropolitan area, the development of limited public recreational facilities on Capers Island could aid immensely in meeting the increasing demand for access to marine recreational fishing.

The numerous tidal creeks between Capers Island and the mainland are highly productive areas, providing the small boat angler an opportunity to catch a variety of marine finfish species. Fish commonly caught in this area include channel bass, sea trout, croaker, whiting, flounder, and spot. A survey conducted during 1973 by the South Carolina WMRD revealed that the Dewees - Capers area ranked sixth in terms of angling effort expended by small boat fishermen among the coastal areas of South Carolina.

Another popular form of fishing is surf fishing; the barrier beach of Capers Island offers some of the best surf fishing to be found along the coast of South Carolina. Fish species caught in this area include channel bass, sea trout, bluefish, whiting, and flounder. Participation in surf fishing activities has been limited during the past on Capers Island because of its private ownership. However, when certain areas are opened to the public, it will provide excellent surf fishing opportunities for an increasing number of marine anglers.

In addition to finfish, the area around Capers Island can provide excellent catches of shrimp and crabs for recreational fishermen. The numerous productive tidal creeks contain large populations of shrimp during certain seasons of the year (June through mid-October), which recreational shrimpers can harvest using cast nets and seines. There are also numerous locations in the area under consideration which are able to provide recreational crabbers with excellent catch using a handline and dip net or a crab trap.

The surrounding intertidal area of Capers Island is currently receiving a lot of fishing pressure on the shellfish beds. Although these areas are leased to a commercial concern, the public continues to put a substantial amount of pressure on the intertidal oysters. These activities have increased substantially and additional public oyster grounds are needed. It is recommended that these bottoms be managed as public shellfish grounds once the current lease expires in 1983. The banks are suitable for intertidal oyster production and would offer an excellent opportunity for the South Carolina Division of Marine Resources to conduct an experimental oyster transplanting operation and simultaneously have public participation. In an effort to provide more State grounds for shellfish activities and public enjoyment,

it is recommended that the shoreline near the existing dock and currently under commercial lease be negotiated for inclusion into the State grounds. The area would be a valuable addition and would negate future problems of public activity on a private lease.

Recommendation IV-H-4

The 110-acre diked marsh area on Capers Island provides an excellent opportunity for research and management investigations of a large saltwater impoundment. The vast majority of existing impoundments within the South Carolina coastal zone have been managed for waterfowl and are either of relatively low salinity (less than 15 o/oo) or even freshwater. Previous investigations have indicated, however, that saltwater ponds having salinities of 15-25 o/oo are highly productive for fish, shrimp, and crabs, in addition to waterfowl. Up to 400-500 pounds per acre of fishes and invertebrates have been produced in a single year in some of these ponds at Bears Bluff Laboratories. The Capers impoundment could be managed as an intermediate or high-salinity pond with relatively minor modifications and thus could be used to provide much additional information as to the productivity and potentials of this type of impoundment.

Although considerable research has been conducted in recent years concerning the ecology, productivity, and values of natural saltmarsh systems, very little is known of the comparative biological and economic aspects of impounded marshes. Studies to determine productivity and energy flow in such impoundments, and to further investigate their potential for the culture of shrimp, blue crabs, shellfish and finfish are needed. Excellent opportunities also exist for the investigation of growth rates, trophic relationships and natural recruitment of fishes and invertebrates in impoundments. Multipurpose management techniques for saltwater impoundments such as for waterfowl and

recreational fishing need to be developed. In addition, an inventory and survey of the types, acreages, etc., of salt and brackish water impoundments in the South Carolina coastal zone is essential.

In general, it is recommended that the Capers Island impoundment be managed as an intermediate to high-salinity (20-30 o/oo) system, with an increased water level. This would provide for a better environment for marine and estuarine fishes, crustaceans and shellfish, as well as suitable habitat for waterfowl, wading birds and mammals. This general type of management would allow for a number of uses and concurrent research activities related to mariculture and coastal ecology.

A tentative research and management plan for the Capers Island impoundment is outlined as follows:

a. Mariculture Studies

Recreational fishing - Investigation of growth rates, productivity and potentials of saltwater impoundments for recreational species such as channel bass, spot, flounder, sea trout, ladyfish, drum, blue crabs and shrimp. Public participation should be encouraged.

Multi-crop utilization - The investigation of commercial production of combined harvests of species such as oysters, soft shell crab, shrimp, fish. Emphasis should be placed on oyster culture and soft-shell blue crab float culture.

Miscellaneous - Other mariculture research might include the use of the impoundment as stock supply for sexually mature animals such as penaeid shrimp, channel bass, mullet, etc., to be used in rearing experiments. These and other species will undergo complete gonadal maturation in high salinity ponds, although successful spawning in the ponds is unlikely.

b. Ecological Studies - Basic studies of biological, chemical and physical processes within saltwater impoundments which control the energetics and productivity of such systems and comparisons with those processes in natural marsh systems. This would include net primary production by marsh plants, benthic algae, phytoplankton, etc.

---Spatial and community structures within the saltwater impoundment system.

---Trophic levels within impoundments.

---Studies of the productivity through techniques such as measurements of Chlorophyll a concentrations, C-14 uptake, inorganic nutrients, etc.

Other biological studies - population composition, and other characteristics of plants, invertebrates, fishes, birds, and mammals utilizing the impoundment.

c. Management-Oriented Studies - In addition to various research studies related to ecology, mariculture, etc., investigations of the feasibility of such impoundments for multi-purpose management activities (waterfowl-fishing-mariculture) could be conducted.

As an example, many of the widgeon grass type impoundments in coastal South Carolina are presently managed primarily for waterfowl in such a way that estuarine fishes and invertebrates recruit into them following winter or early spring draw down and during the growing season when water is taken in through the floodgates. Often shrimp, crabs and fish which enter such ponds have no way to escape and either suffer heavy mortalities with the advent of cold weather (white shrimp) or merely remain in the impoundments unutilized (channel bass, flounder, blue crabs, etc.). The feasibility of utilizing such resources, or developing management techniques such as short-term fall draw down in September or October, prior to the waterfowl season, in order to allow for harvest or escapement of shrimp, crabs, and fishes, should be investigated.

Whether this is possible without affecting vegetative growth should be considered along with the potential benfits of such management practices on a large scale.

d. Wildlife Studies - In cooperation with the Fish and Game Division of the South Carolina Wildlife and Marine Resources Department, a general wildlife inventory should be conducted to furnish information on wildlife populations. Accurate data are needed on which, if any,

natural populations are depleted. Conversely, over-populated wildlife species should be identified for controlled reduction.

e. Educational Uses - The use of Capers Island for scientific purposes is obviously an important aspect of any future use plan. However, the idea of graduate and professional levels of education and research should not represent the total educational emphasis. the area is an outstanding field laboratory for high school biology classes to escape from arm chair philosophy and literally experience the "senses" of nature. Educators should have the opportunity to develop within their students an appreciation and awareness towards the maintenance and proper utilization of the coastal environment.

It is recommended that Capers Island be made available as an outdoor laboratory/museum for school age groups. A program should be developed, in cooperation with the Information and Education Division, to assist educators towards fulfillment of marine science field projects with special references to the use of Capers Island.

V. MARINE RESOURCES PROGRAM FUNDING BASE

Charge

The third phase of the charge to the Committee dealt with the funding base of the Marine Resources Program. This would involve analyzing the funding sources that support the Marine Center's Programs, determining funding needs in light of recommended areas of program emphasis for the future and making recommendations regarding alternatives for funding these programs.

Background

The DMR provides the conservation and management of the marine resources of South Carolina. In this context, marine resources refer to anything of value or potential value inherent in or directly dependent on the marine environment for its existence. Marine resources may be living or non-living, consumed or not consumed, and renewable or non-renewable. A principal mission of the DMR is the development of a sufficient information base and the achievement of sufficient understanding of marine resources in order to provide wise management policies on behalf of the citizens of the State. As such, the DMR operates a comprehensive marine resources research program and is responsible for day-to-day conservation and management activities regarding marine resources for commercial and recreational utilization along the coast.

The underlying operational philolsophy of the DMR, responsive to that of the Executive Director of the South Carolina WMRD, is that all activities

shall be carried on through utilization of existing staff. No staff-expansion mode is projected as part of foreseeable future plans. This circumstance sets a major operational constraint on the marine resources program. It requires that the DMR administration look to fostering of a dynamic, continuously revised program featuring frequent shifts in program focus. While there are both obvious benefits and obvious disbenefits from this constraint, we believe it has the very great advantage of realism.

Total 1980 budget for WMRD - $19 million

Budget only for the DMR - $3.5 million

having three components:

State appropriations = $2.1 million

Federal funds = $1.4 million

The State funds are devoted almost entirely to the maintenance of the MRRI "Plant" (research laboratory) and to the operations of its appurtenant boats.

Funding Problems:

The funding problems are divisible into three main program areas: (1) administration; (2) conservation, management, and marketing; and (3) research laboratories, as follows:

1. Administration

This includes the cost of operating the needed research vessels, building maintenance and custodial care, as well as the program administrative costs.

Among these items, there is very tight funding of utilities (natural gas boilers) for the MRRI facilities. There are no back-up systems on coal/oil.

This results in classification as a firm utilities customer (vs. an interruptible customer) and related higher rate charge.

Approximataely $200K is spent annually for gas and electricity. The DMR furnishes same as needed to the Medical University of South Carolina and to the Grice Laboratory of the College of Charleston, for which only nominal reimbursement is collected ($12K). No actual-value reimbursement is received for utilities within the Marine Research Center.

What may be needed here is a reevaluation of the existing cooperative agreements with other involved entities for their use of MRRI facilities. Also possibly needed is a review of the adequacy of the existing boat-use rate structure for the four vessels maintained by the DMR.

With respect to vessel operations, the DMR is exploring the possibility of acquiring the MV OREGON I, now surplus to the needs of the NMFS. The purpose of such acquisition would be to substitute a more efficient vessel for the currently-owned MV DOLPHIN II. The result would be to effect significant reduction in vessel operational costs.

2. Conservation, Management, and Marketing

These activities are funded largely out of appropriated State funds. There is a perceived need to generate a financially more self-sufficient approach here, to the extent practicable invoking some kinds of special funding featuring direct payment of fees for direct services being rendered to various classes of resource users.

This user-payment principle may be especially justifiable and acceptable with respect to projects designed for:

--development of public oyster grounds

--construction, buoying, and buoy replacement for artificial fishing reefs

--marketing activities, coordinating closely with alternative State program resources.

3. Research Laboratories.

All the activities at the MRRI are supported by Federal funds earmarked for specifically contracted services.

In this respect, 54 people are supported exclusively by Federal contract funds. Only 36 people are supported on State funds.

This circumstance, though oriented along lines and activities having great significance to overall State resource needs and user interests, leaves no flexibility for response to short-term State management needs, when required or desirable. Such capability is badly needed but is not available under circumstances of exclusive Federal contract funding. A higher State-funding base is needed.

Additionally, a serious cash-flow problem exists that is directly related to Federal funding. This condition prevails because payments are received for the most part in the form of reimbursements after the fact of work accomplished. The 1980-1981 Appropriation Bill contained a proviso as follows:

> "That fees and other revenue collected by the Marine Resources Division shall be deposited in the State Treasury in a special account to the credit of the Wildlife and Marine Resources Department and may be expanded in the operation of the Marine Resources Division. Provided, however, that it is the intent of the General Assembly that such revenues shall be remitted to the General Fund of the State beginning with the fiscal year 1980-81."

The above action has adversely affected the "cash flow" associated with Federal grants and contracts of which most are cost reimbursable. Operating funds necessary to implement Federal projects on a cost reimbursable basis is practically nil, other than those project that letter-of-credit deposits are authorized.

One approach to resolving this problem possibly would be to negotiate with the State Budget and Control Board to advance funds on some reasonable basis for operating projects with a transfer back to the State upon receipt of Federal funds (approximately $400,000).

The base operating budget for the MRRI needs additional State appropriations to adequately support research inhouse, to supplement the resource management function by OCMM. Sixty (60) percent of the positions in the MRRI are funded by Federal grants and contracts. Those positions are restricted to carrying out the work statement on each project and cannot be utilized on other work. It would be appropriate to increase the number of technical and professional personnel to do in-house research. Also, the operating budget for supplies and other budgeted items should be increased (approximately $100,000).

Physical plant budget should also have an increase in the base to adequately maintain the facilities (approximately $100,000). Energy cost alone accounts for 60 percent of the present total budget for the Administation program area of which the physical plant is a part.

Consideration should be given to increasing the various licenses and fees dealing with commerical fisheries. Although these monies presently revert to the State general fund, they, in part, would supplement additional

funding required from the general fund in the form of "appropriations."

Careful assessment of new proposals for submission to Federal agencies should be made thoroughly and selectively for those projects that are appropriate for the State of South Carolina and within the DMR's goals.

Source of Funds

The principal sources of funds for support of the DMR operations, including the activities of the MRRI, are either State appropriations or Federal grants or contract-study reimbursements. It is noteworthy that in less than a decade, total funding for the MRRI has been nearly tripled (TABLE XIII). This has undoubtedly greatly multiplied the significance of the work being done and contributed substantially to economic development within the State of South Carolina.

At the same time, notwithstanding a 41 percent increase in State monies available over this period, the influx of Federal monies has grown nearly sevenfold (TABLE XIV). This circumstance means that the relationship between these two major sources has taken a potentially troublesome turn over the years. In fiscal year 1973 some two-thirds of MRRI funding was supplied out of State appropriated funds, only one-third coming from Federal agencies. In less than a decade, by fiscal year 1980, that funding relationship was exactly reversed--one-third from State sources, two-thirds from Federal sources. The effect is to place the State under very tight operational constraints (TABLE).

Comments and Recommendations

On August 11, 1980, the Chairman of the Marine Resources Study Committee received a copy of the "Draft Report of the Study Committee on Program Funding for the South Carolina Wildlife and Marine Resources Commission & Department" from Dr. Timmerman. The passages relating to the DMR are as follows:

> "The Marine Resources Research Institute is heavily dependent upon federal grants and contracts for research personnel. These personnel are restricted to carrying out the work statement on each project and cannot be used for other research needs. As such, funds are needed from a source other than federal funds in order to maintain a continuous research staff and provide research needed for the program. In addition, energy costs for operating the Marine Center's physical plant have increased substantially over the past years and some funding relief is needed in this areas so it will free up funds for other operating needs for the Marine Resources Program."
>
> "E. Marine Sub-Committee
>
> At the time the Study Committee on Program Funding was developed in early 1980, the Department was also in the process of developing a Marine Resources Study Committee to evaluate the Marine resources program and develop recommendations for their future direction. Part of their work has also included the analysis of funding problems and the development of funding alternatives for the marine resources program. In this regard,

the Marine Resources Study Committee's funding alternatives are being incorporated into this report. These are as follows:

"21. Problem Identification:

The 1980-81 State Appropriations Bill contains a proviso as follows:

"That fees and other revenue collected by the Marine Resources Division shall be deposited in the State Treasury in a special account to the credit of the Wildlife and Marine Resources Department and may be expended in the operation of the Marine Resources Division. Provided, however, that it is the intent of the General Assembly that such revenues shall be remitted to the General Fund of the State beginning with the fiscal year 1980-81."

"This action has adversely affected the "cash flow" associated with federal grants and contracts at the Marine Center of which most are cost reimburseable. Operating funds necessary to implement federal projects on a cost reimburseable basis is practically nil, other than those projects that letter-of-credit deposits are authorized; thus, this restricts many program activities which are needed at the Marine Center.

"Recommended Alternative #21: One approach to resolving this problem would be to negotiate with the State Budget and Control Board to advance funds on some reasonable basis for operating projects with a transfer back to the State upon receipt of Federal fund reimbursements under federal contracts at the Marine Center. Approximately $400,000 would be needed under such an arrangement.

"22. Problem Identification: The base operating budget for the Marine Resources Research Institute needs additional state appropriations to adequately support research in-house and to supplement the resources management function of the Office of Conservation, Management and Marketing. Sixty percent of the positions in the Institute are funded by federal grants and contracts. These positions are restricted to carrying out the work statement on each project and cannot be utilized on other work.

"Recommended Alternative #22: It would be appropriate to increase the number of technical and professional staff to conduct in-house research at the Marine Resources Research Institute. In addition, the operating budget for supplies and other items should be increased. Approximately $250,000 in state funds would be needed in order to implement this alternative.

"23. Problem Identification: Excessive increases in energy costs over the past few years has put a great deal of pressure on available operating funds at the Marine Resources Center. Energy costs alone account for 60 percent of the present total budget for the Marine Resources Administration Program of which the physical plant is a part.

"Recommended Alternative #23: The physical plant budget should have an increase of about $100,000 to adequately maintain the facilities. In addition, Department of Energy funds to the state should be utilized to conduct engineering studies on the Marine Center's physical plant and recommend and find ways to improve the energy efficiency of the energy systems at the Marine Center.

"24. Problem Identification: The Marine Center sells commercial fishing licenses which entails about $300,000 per year for their operations and various programs need additional funds in order to fulfill the overall mission of the Marine Resources Program.

"Recommended Alternative #24: Consideration should be given to increasing the various licenses and fees dealing with commercial fisheries. Although these monies presently revert to the State General Fund, they (in part) would supplement additional funding required from the General fund in the form of "appropriations".

"25. Problem Identification: A continuous source of funds for the maintenance and upkeep of artificial fishing reefs is needed. These funds would be used to add material to existing reefs, construct new reefs and provide replacement buoys as needed which are used to mark the reefs.

"Recommended Alternative #25: Approximately $50,000 per year in State appropriated funds should be provided for the artificial reef program in order to properly maintain reefs and construct new reefs as needed.

"26. Problem Identification: The state public shellfish grounds need to be properly maintained on an annual basis. This was previously discussed in Problem Identification # 18. Funds are needed for transplanting seed, planting shell, maintaining signs, and the like. A continuous fund source for this program is needed.

"Recommendation Alternative #26: Approximately $50,00 per year in State appropriated funds should be provided for the state public shellfish grounds in order that such can be properly maintained for public use.

"V. Conclusions (in part): ...in order for the South Carolina Wildlife and Marine Resources Department to continue providing an adequate level of service delivery and maintain quality ... fishing opportunities in the future, the user of the state's ... marine resources is going to have to pay his way and his fair share for use of these records."

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Recommendation V-A

See "Recommended alternative #21"

Recommendation V-B

See "Recommended Alternative #22"

Recommendation V-C

See "Recommended Alternative #23"

Recommendation V-D

See "Recommended Alternative #24"

Recommendation V-E

See "Recommended Alternative #25"

Recommendation V-F

See "Recommended Alternative #26"#

Recommendation V-G

The Committee endorses the foregoing recommendations and adds another, consistent with Conclusion V of the Draft Report (cited above), that the direct users of the marine resources should pay their way in the future. Our further recommendation is that a Marine Recreational Fishing (MRF) license be instituted.

NOTE: There are basically two reasons why there is a need for a saltwater angling icense.

They are:

1. To provide funds through saltwater license sales to South Carolina anglers for the management and enhancement of marine fish stocks and for the protection of marine fish habitat, especially within the Territorial Sea.

2. To identify the major part of the universe of saltwater angling participants for reliable statistical sampling

> to provide information and trends about their participation and harvest which are necessary for the proper management of marine fisheries. Such data already exist for the marine commercial fisheries.

It is becoming reasonably evident that saltwater sport fisheries research and development programs are increasingly needed in the near-shore waters of the coastal zone. Saltwater angling participation is increasing year by year at a rate estimated to exceed three times that of general population growth. Opportunities to get to or on coastal waters to fish are disappearing as private development exploits the shoreline. At the same time, estuarine habitat, critically important as breeding and nursery grounds for many species of saltwater sport fisheries, is being gradually obliterated.

It is essential to keep pace with growing fishing pressures on coastals port fisheries resources, and assure future good fishing. To do so, the State must provide and maintain abundant fishing facilities and pursue continuing research programs designed to develop (through experiment), evaluate, and fine-tune beneficial fish management practices. The State has the legal jurisdiction over the critical estuarine habitat and the Territorial Sea (out to 3 miles)--not the Federal Government.

Of the varied suggestions that have been made for financing comprehensive State action programs of this sort, only those that involve State-issued saltwater angling licenses have the potential to raise signficant sums of money for use by the State on a continuing basis for such programs. The licensing proposals are the only ones that provide reasonable protection from intrusion and diversion of revenues to non-related purposes.

Saltwater license revenues, therefore, must be segregated in dedicated funds. Indeed, it would be a serious blunder to adopt saltwater licensing without such a provision. There is abundant precedent for segregating such revenues. The machinery to protect such funds already exists and provision

for segregation of the revenues in the existing earmarked fund, for use only by the administering agency exclusively in saltwater sport fisheries programs, can be incorporated in the saltwater licensing law.

The programs can be further insulated against intrusion if a specially designated policy-making Commission is established, or if the existing such Commission is appropriately reorganized, charged with the responsibility of overseeing the saltwater sport fisheries program.

On the average, nationally, only about 10 cents of each freshwater fish conservation expenditure dollar goes for administration, 5 cents goes for public information and 25 cents goes for law enforcement. This leaves 60 cents out of each dollar for the vital research and fish management activities. In saltwater sport fishing programs, it seems likely that a similar general pattern of expenditure would develop.

Of the 60 cents for research and management, expectations are that 25 to 30 cents, more or less, would be spent on "practical" research in developing beneficial fish management practices. The remaining 30 to 35 cents would be used to provide whatever angling facilities are needed in each State--access sites and parking areas, boat launching ramps, fishing piers, bridge outwalks, artificial reefs, beach areas, etc. The particulars of the South Carolina program would obviously be tailored in accordance with the specialized needs of the State.

Saltwater sport fishing licenses appear to represent one of the most practical means presently known whereby substantial continuing revenues can be raised for use in the State's marine fishery program to benefit anglers directly. Several national surveys have demonstrated, despite significant minority opposition, that there is majority acceptance of this circumstance in the angling community, coupled with widespread recognition of saltwater

angling program needs. If an annual fee of $3.00 is charged, total revenues that could be raised in South Carolina might well exceed $1 million. The exact amount would depend on the extent of exclusions that may be specified with respect to the very young, the handicapped, the elderly, perhaps others, as well as the actual numbers of anglers (estimated in 1974 to include 396,000 fin fishermen plus 283,000 shell fishermen--less unknown duplication between the two categories).

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